PHILIPS

Data handbook

Electronic
components
and materials

Semiconductors

Part 10 July 1983

Wideband transistors and Wideband hybrid IC modules

DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, subassemblies and materials; it is made up of four series of handbooks each comprising several parts.

ELECTRON TUBES	BLUE
SEMICONDUCTORS	RED
INTEGRATED CIRCUITS	PURPLE
COMPONENTS AND MATERIALS	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

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ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks is comprised of the following parts:

T1	**Tubes for r.f. heating**
T2	**Transmitting tubes for communications**
T3	**Klystrons, travelling-wave tubes, microwave diodes**
ET3	**Special Quality tubes, miscellaneous devices** (will not be reprinted)
T4	**Magnetrons**
T5	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications
T6	**Geiger-Müller tubes**
T7	**Gas-filled tubes** Segment indicator tubes, indicator tubes, dry reed contact units, thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes, associated accessories
T8	**Picture tubes and components** Colour TV picture tubes, black and white TV picture tubes, colour monitor tubes for data graphic display, monochrome monitor tubes for data graphic display, components for colour television, components for black and white television and monochrome data graphic display
T9	**Photo and electron multipliers** Photomultiplier tubes, phototubes, single channel electron multipliers, channel electron multiplier plates
T10	**Camera tubes and accessories, image intensifiers**
T11	**Microwave semiconductors and components**

SEMICONDUCTORS

PART 10 - JULY 1983

WIDEBAND TRANSISTORS AND WIDEBAND HYBRID IC MODULES

DATA HANDBOOK SYSTEM
SEMICONDUCTOR INDEX

GENERAL

WIDEBAND TRANSISTORS

HYBRID IC MODULES:

CATV AMPLIFIER MODULES (V.H.F.)

WIDEBAND AMPLIFIERS (V.H.F. & U.H.F.)

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks is comprised of the following parts:

S1 **Diodes**
Small-signal germanium diodes, small-signal silicon diodes, voltage regulator diodes($<$ 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes

S2 **Power diodes, thyristors, triacs**
Rectifier diodes, voltage regulator diodes ($>$ 1,5 W), rectifier stacks, thyristors, triacs

S3 **Small-signal transistors**

S4 **Low-frequency power transistors and hybrid IC modules**

S5 **Field-effect transistors**

S6 **R.F. power transistors and modules**

S7 **Microminiature semiconductors for hybrid circuits**

S8 **Devices for optoelectronics**
Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices.

S9 Taken into handbook T11 of the blue series

S10 **Wideband transistors and wideband hybrid IC modules**

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks is comprised of the following parts:

IC1	**Bipolar ICs for radio and audio equipment**
IC2	**Bipolar ICs for video equipment**
IC3	**ICs for digital systems in radio, audio and video equipment**
IC4	**Digital integrated circuits** CMOS HE4000B family
IC5	**Digital integrated circuits – ECL** ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs
IC6	**Professional analogue integrated circuits**
IC7	**Signetics bipolar memories**
IC8	**Signetics analogue circuits**
IC9	**Signetics TTL logic**
IC10	**Signetics Integrated Fuse Logic (IFL)**
IC11	**Microprocessors, microcomputers and peripheral circuitry**

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks is comprised of the following parts:

C1 **Assemblies for industrial use**
PLC modules, PC20 modules, HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices, hybrid ICs

C2 **Television tuners, video modulators, surface acoustic wave filters**

C3 **Loudspeakers**

C4 **Ferroxcube potcores, square cores and cross cores**

C5 **Ferroxcube for power, audio/video and accelerators**

C6 **Electric motors and accessories**
Permanent magnet synchronous motors, stepping motors, direct current motors

C7 **Variable capacitors**

C8 **Variable mains transformers**

C9 **Piezoelectric quartz devices**
Quartz crystal units, temperature compensated crystal oscillators, compact integrated oscillators, quartz crystal cuts for temperature measurements

C10 **Connectors**

C11 **Non-linear resistors**
Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)

C12 **Variable resistors and test switches**

C13 **Fixed resistors**

C14 **Electrolytic and solid capacitors**

C15 **Film capacitors, ceramic capacitors**

C16 **Piezoelectric ceramics, permanent magnet materials**

SEMICONDUCTOR INDEX

INDEX OF TYPE NUMBERS

Data Handbooks S1 to S10

The inclusion of a type number in this publication does not necessarily imply its availability.

type no.	book	section
AA119	S1	GD
AAZ15	S1	GD
AAZ17	S1	GD
AAZ18	S1	GD
BA220	S1	SD
BA221	S1	SD
BA223	S1	T
BA243	S1	T
BA244	S1	T
BA280	S1	T
BA314	S1	Vrg
BA315	S1	Vrg
BA316	S1	SD
BA317	S1	SD
BA318	S1	SD
BA379	S1	T
BA423	S1	T
BA481	S1	T
BA482	S1	T
BA483	S1	T
BA484	S1	T
BAS11	S1	SD
BAS16	S7/S1	Mm/SD
BAS17	S7/S1	Mm/Vrg
BAS18	S1	SD
BAS19	S7/S1	Mm/SD
BAS20	S7/S1	Mm/SD
BAS21	S7/S1	Mm/SD
BAT17	S7/S1	Mm/T
BAT18	S7/S1	Mm/T
BAT81	S1	T
BAT82	S1	T
BAT83	S1	T
BAT85	S1	T
BAV10	S1	SD
BAV18	S1	SD
BAV19	S1	SD
BAV20	S1	SD
BAV21	S1	SD
BAV45	S1	Sp
BAV70	S7/S1	Mm/SD
BAV99	S7/S1	Mm/SD
BAW56	S7/S1	Mm/SD
BAW62	S1	SD
BAX12	S1	SD
BAX12A	S1	SD
BAX14	S1	SD
BAX18	S1	SD
BB105B	S1	T
BB105G	S1	T
BB109G	S1	T
BB112	S1	T
BB119	S1	T
BB130	S1	T
BB204B	S1	T
BB204G	S1	T
BB212	S1	T
BB405B	S1	T
BB405G	S1	T
BB417	S1	T
BB809	S1	T
BB909A	S1	T
BB909B	S1	T
BBY31	S7/S1	Mm/T
BBY40	S7/S1	Mm/T
BC107	S3	Sm
BC108	S3	Sm
BC109	S3	Sm
BC146	S3	Sm
BC177	S3	Sm
BC178	S3	Sm
BC179	S3	Sm
BC200	S3	Sm
BC264A	S5	FET
BC264B	S5	FET

FET = Field-effect transistors
GD = Germanium diodes
Mm = Microminiature semiconductors for hybrid circuits
SD = Small-signal diodes
Sm = Small-signal transistors
Sp = Special diodes
T = Tuner diodes
Vrg = Voltage regulator diodes

type no.	book	section
BC264C	S5	FET
BC264D	S5	FET
BC327;A	S3	Sm
BC328	S3	Sm
BC337;A	S3	Sm
BC338	S3	Sm
BC368	S3	Sm
BC369	S3	Sm
BC375	S3	Sm
BC376	S3	Sm
BC546	S3	Sm
BC547	S3	Sm
BC548	S3	Sm
BC549	S3	Sm
BC550	S3	Sm
BC556	S3	Sm
BC557	S3	Sm
BC558	S3	Sm
BC559	S3	Sm
BC560	S3	Sm
BC635	S3	Sm
BC636	S3	Sm
BC637	S3	Sm
BC638	S3	Sm
BC639	S3	Sm
BC640	S3	Sm
BC807	S7	Mm
BC808	S7	Mm
BC817	S7	Mm
BC818	S7	Mm
BC846	S7	Mm
BC847	S7	Mm
BC848	S7	Mm
BC849	S7	Mm
BC850	S7	Mm
BC856	S7	Mm
BC857	S7	Mm
BC858	S7	Mm
BC859	S7	Mm
BC860	S7	Mm
BC868	S7	Mm
BC869	S7	Mm
BCF29;R	S7	Mm
BCF30;R	S7	Mm
BCF32;R	S7	Mm
BCF33;R	S7	Mm
BCF70;R	S7	Mm
BCF81;R	S7	Mm
BCV71;R	S7	Mm
BCV72;R	S7	Mm
BCW29;R	S7	Mm
BCW30;R	S7	Mm
BCW31;R	S7	Mm
BCW32;R	S7	Mm
BCW33;R	S7	Mm
BCW60*	S7	Mm
BCW61*	S7	Mm
BCW69;R	S7	Mm
BCW70;R	S7	Mm
BCW71;R	S7	Mm
BCW72;R	S7	Mm
BCW81;R	S7	Mm
BCW89;R	S7	Mm
BCX17;R	S7	Mm
BCX18;R	S7	Mm
BCX19;R	S7	Mm
BCX20;R	S7	Mm
BCX51	S7	Mm
BCX52	S7	Mm
BCX53	S7	Mm
BCX54	S7	Mm
BCX55	S7	Mm
BCX56	S7	Mm
BCX70*	S7	Mm
BCX71*	S7	Mm
BCY56	S3	Sm
BCY57	S3	Sm
BCY58	S3	Sm
BCY59	S3	Sm
BCY70	S3	Sm
BCY71	S3	Sm
BCY72	S3	Sm
BCY78	S3	Sm
BCY79	S3	Sm
BCY87	S3	Sm
BCY88	S3	Sm
BCY89	S3	Sm
BD131	S4	P
BD132	S4	P
BD135	S4	P
BD136	S4	P
BD137	S4	P
BD138	S4	P
BD139	S4	P
BD140	S4	P
BD201	S4	P
BD202	S4	P
BD203	S4	P
BD204	S4	P
BD226	S4	P
BD227	S4	P
BD228	S4	P
BD229	S4	P
BD230	S4	P
BD231	S4	P
BD233	S4	P
BD234	S4	P
BD235	S4	P
BD236	S4	P
BD237	S4	P
BD238	S4	P
BD291	S4	P
BD292	S4	P
BD293	S4	P
BD294	S4	P
BD295	S4	P
BD296	S4	P
BD329	S4	P
BD330	S4	P
BD331	S4	P

* = series

FET = Field-effect transistors

Mm = Microminiature semiconductors for hybrid circuits

P = Low-frequency power transistors

Sm = Small-signal transistors

type no.	book	section
BD332	S4	P
BD333	S4	P
BD334	S4	P
BD335	S4	P
BD336	S4	P
BD337	S4	P
BD338	S4	P
BD433	S4	P
BD434	S4	P
BD435	S4	P
BD436	S4	P
BD437	S4	P
BD438	S4	P
BD645	S4	P
BD646	S4	P
BD647	S4	P
BD648	S4	P
BD649	S4	P
BD650	S4	P
BD651	S4	P
BD652	S4	P
BD675	S4	P
BD676	S4	P
BD677	S4	P
BD678	S4	P
BD679	S4	P
BD680	S4	P
BD681	S4	P
BD682	S4	P
BD683	S4	P
BD684	S4	P
BD813	S4	P
BD814	S4	P
BD815	S4	P
BD816	S4	P
BD817	S4	P
BD818	S4	P
BD825	S4	P
BD826	S4	P
BD827	S4	P
BD828	S4	P
BD829	S4	P
BD830	S4	P
BD839	S4	P
BD840	S4	P
BD841	S4	P
BD842	S4	P
BD843	S4	P
BD844	S4	P
BD933	S4	P
BD934	S4	P
BD935	S4	P
BD936	S4	P
BD937	S4	P
BD938	S4	P
BD939	S4	P
BD940	S4	P
BD941	S4	P
BD942	S4	P
BD943	S4	P
BD944	S4	P
BD945	S4	P
BD946	S4	P
BD947	S4	P
BD948	S4	P
BD949	S4	P
BD950	S4	P
BD951	S4	P
BD952	S4	P
BD953	S4	P
BD954	S4	P
BD955	S4	P
BD956	S4	P
BDT29	S4	P
BDT29A	S4	P
BDT29B	S4	P
BDT29C	S4	P
BDT30	S4	P
BDT30A	S4	P
BDT30B	S4	P
BDT30C	S4	P
BDT31	S4	P
BDT31A	S4	P
BDT31B	S4	P
BDT31C	S4	P
BDT32	S4	P
BDT32A	S4	P
BDT32B	S4	P
BDT32C	S4	P
BDT41	S4	P
BDT41A	S4	P
BDT41B	S4	P
BDT41C	S4	P
BDT42	S4	P
BDT42A	S4	P
BDT42B	S4	P
BDT42C	S4	P
BDT60	S4	P
BDT60A	S4	P
BDT60B	S4	P
BDT60C	S4	P
BDT61	S4	P
BDT61A	S4	P
BDT61B	S4	P
BDT61C	S4	P
BDT62	S4	P
BDT62A	S4	P
BDT62B	S4	P
BDT62C	S4	P
BDT63	S4	P
BDT63A	S4	P
BDT63B	S4	P
BDT63C	S4	P
BDT64	S4	P
BDT64A	S4	P
BDT64B	S4	P
BDT64C	S4	P
BDT65	S4	P
BDT65A	S4	P
BDT65B	S4	P

P = Low-frequency power transistors

type no.	book	section
BDT65C	S4	P
BDT91	S4	P
BDT92	S4	P
BDT93	S4	P
BDT94	S4	P
BDT95	S4	P
BDT96	S4	P
BDV64	S4	P
BDV64A	S4	P
BDV64B	S4	P
BDV64C	S4	P
BDV65	S4	P
BDV65A	S4	P
BDV65B	S4	P
BDV65C	S4	P
BDV91	S4	P
BDV92	S4	P
BDV93	S4	P
BDV94	S4	P
BDV95	S4	P
BDV96	S4	P
BDW55	S4	P
BDW56	S4	P
BDW57	S4	P
BDW58	S4	P
BDW59	S4	P
BDW60	S4	P
BDX35	S4	P
BDX36	S4	P
BDX37	S4	P
BDX42	S4	P
BDX43	S4	P
BDX44	S4	P
BDX45	S4	P
BDX46	S4	P
BDX47	S4	P
BDX62	S4	P
BDX62A	S4	P
BDX62B	S4	P
BDX62C	S4	P
BDX63	S4	P
BDX63A	S4	P
BDX63B	S4	P
BDX63C	S4	P
BDX64	S4	P
BDX64A	S4	P
BDX64B	S4	P
BDX64C	S4	P
BDX65	S4	P
BDX65A	S4	P
BDX65B	S4	P
BDX65C	S4	P
BDX66	S4	P
BDX66A	S4	P
BDX66B	S4	P
BDX66C	S4	P
BDX67	S4	P
BDX67A	S4	P
BDX67B	S4	P
BDX67C	S4	P
BDX77	S4	P
BDX78	S4	P
BDX91	S4	P
BDX92	S4	P
BDX93	S4	P
BDX94	S4	P
BDX95	S4	P
BDX96	S4	P
BDY90	S4	P
BDY90A	S4	P
BDY91	S4	P
BDY92	S4	P
BF180	S3	Sm
BF181	S3	Sm
BF182	S3	Sm
BF183	S3	Sm
BF198	S3	Sm
BF199	S3	Sm
BF200	S3	Sm
BF240	S3	Sm
BF241	S3	Sm
BF245A	S5	FET
BF245B	S5	FET
BF245C	S5	FET
BF246A	S5	FET
BF246B	S5	FET
BF246C	S5	FET
BF256A	S5	FET
BF256B	S5	FET
BF256C	S5	FET
BF324	S3	Sm
BF370	S3	Sm
BF410A	S5	FET
BF410B	S5	FET
BF410C	S5	FET
BF410D	S5	FET
BF419	S4	P
BF422	S3	Sm
BF423	S3	Sm
BF450	S3	Sm
BF451	S3	Sm
BF457	S4	P
BF458	S4	P
BF459	S4	P
BF469	S4	P
BF470	S4	P
BF471	S4	P
BF472	S4	P
BF480	S3	Sm
BF494	S3	Sm
BF495	S3	Sm
BF496	S3	Sm
BF510	S7	Mm
BF511	S7	Mm
BF512	S7	Mm
BF513	S7	Mm
BF536	S7	Mm
BF550;R	S7	Mm
BF569	S7	Mm
BF579	S7	Mm

FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
Sm = Small-signal transistors

type no.	book	section
BF620	S7	Mm
BF621	S7	Mm
BF622	S7	Mm
BF623	S7	Mm
BF660;R	S7	Mm
BF689K	S10	WBT
BF767	S7	Mm
BF819	S4	P
BF820	S7	Mm
BF821	S7	Mm
BF822	S7	Mm
BF823	S7	Mm
BF857	S4	P
BF858	S4	P
BF859	S4	P
BF869	S4	P
BF870	S4	P
BF871	S4	P
BF872	S4	P
BF926	S3	Sm
BF936	S3	Sm
BF939	S3	Sm
BF960	S5	FET
BF964	S5	FET
BF966	S5	FET
BF967	S3	Sm
BF970	S3	Sm
BF979	S3	Sm
BF980	S5	FET
BF981	S5	FET
BF982	S5	FET
BF989	S7	Mm
BF990	S7	Mm
BF991	S7	Mm
BF992	S7	Mm
BF994	S7	Mm
BF996	S7	Mm
BFG90A	S10	WBT
BFG91A	S10	WBT
BFG96	S10	WBT
BFP90A	S10	WBT
BFP91A	S10	WBT
BFP96	S10	WBT
BFQ10	S5	FET
BFQ11	S5	FET
BFQ12	S5	FET
BFQ13	S5	FET
BFQ14	S5	FET
BFQ15	S5	FET
BFQ16	S5	FET
BFQ17	S7	Mm
BFQ18A	S7	Mm
BFQ19	S7	Mm
BFQ22	S10	WBT
BFQ22S	S10	WBT
BFQ23	S10	WBT
BFQ24	S10	WBT
BFQ32	S10	WBT
BFQ33	S10	WBT
BFQ34	S10	WBT
BFQ34T	S10	WBT
BFQ42	S6	RFP
BFQ43	S6	RFP
BFQ51	S10	WBT
BFQ52	S10	WBT
BFQ53	S10	WBT
BFQ63	S10	WBT
BFQ65	S10	WBT
BFQ66	S10	WBT
BFQ68	S10	WBT
BFR29	S5	FET
BFR30	S7	Mm
BFR31	S7	Mm
BFR49	S10	WBT
BFR53;R	S7	Mm
BFR54	S3	Sm
BFR64	S10	WBT
BFR65	S10	WBT
BFR84	S5	FET
BFR90	S10	WBT
BFR90A	S10	WBT
BFR91	S10	WBT
BFR91A	S10	WBT
BFR92;R	S7	Mm
BFR92A;R	S7	Mm
BFR93;R	S7	Mm
BFR93A;R	S7	Mm
BFR94	S10	WBT
BFR95	S10	WBT
BFR96	S10	WBT
BFR96S	S10	WBT
BFR101A;B	S7	Mm
BFS17;R	S7	Mm
BFS18;R	S7	Mm
BFS19;R	S7	Mm
BFS20;R	S7	Mm
BFS21	S5	FET
BFS21A	S5	FET
BFS22A	S6	RFP
BFS23A	S6	RFP
BFT24	S10	WBT
BFT25;R	S7	Mm
BFT44	S3	Sm
BFT45	S3	Sm
BFT46	S7	Mm
BFT92;R	S7	Mm
BFT93;R	S7	Mm
BFW10	S5	FET
BFW11	S5	FET
BFW12	S5	FET
BFW13	S5	FET
BFW16A	S10	WBT
BFW17A	S10	WBT
BFW30	S10	WBT
BFW61	S5	FET
BFW92	S10	WBT
BFW92A	S10	WBT
BFW93	S10	WBT
BFX29	S3	Sm
BFX30	S3	Sm

FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors
RFP = R.F. power transistors and modules
Sm = Small-signal transistors
WBT = Wideband hybrid IC transistors

type no.	book	section
BFX34	S3	Sm
BFX84	S3	Sm
BFX85	S3	Sm
BFX86	S3	Sm
BFX87	S3	Sm
BFX88	S3	Sm
BFX89	S10	WBT
BFY50	S3	Sm
BFY51	S3	Sm
BFY52	S3	Sm
BFY55	S3	Sm
BFY90	S10	WBT
BG2000	S1	RT
BG2097	S1	RT
BGX11*	S2	ThM
BGX12*	S2	ThM
BGX13*	S2	ThM
BGX14*	S2	ThM
BGX15*	S2	ThM
BGX17*	S2	ThM
BGY22	S6	RFP
BGY22A	S6	RFP
BGY23	S6	RFP
BGY23A	S6	RFP
BGY32	S6	RFP
BGY33	S6	RFP
BGY35	S6	RFP
BGY36	S6	RFP
BGY40A	S6	RFP
BGY40B	S6	RFP
BGY41A	S6	RFP
BGY41B	S6	RFP
BGY43	S6	RFP
BGY50	S10	WBM
BGY51	S10	WBM
BGY52	S10	WBM
BGY53	S10	WBM
BGY54	S10	WBM
BGY55	S10	WBM
BGY56	S10	WBM
BGY57	S10	WBM
BGY58	S10	WBM
BGY58A	S10	WBT
BGY59	S10	WBM
BGY60	S10	WBM
BGY61	S10	WBT
BGY65	S10	WBT
BGY67	S10	WBT
BGY70	S10	WBT
BGY71	S10	WBT
BGY74	S10	WBM
BGY75	S10	WBM
BLV10	S6	RFP
BLV11	S6	RFP
BLV20	S6	RFP
BLV21	S6	RFP
BLV25	S6	RFP
BLV30	S6	RFP
BLV31	S6	RFP
BLV32F	S6	RFP
BLV33	S6	RFP
BLV33F	S6	RFP
BLV36	S6	RFP
BLV57	S6	RFP
BLW29	S6	RFP
BLW31	S6	RFP
BLW32	S6	RFP
BLW33	S6	RFP
BLW34	S6	RFP
BLW50F	S6	RFP
BLW60	S6	RFP
BLW60C	S6	RFP
BLW64	S6	RFP
BLW75	S6	RFP
BLW76	S6	RFP
BLW77	S6	RFP
BLW78	S6	RFP
BLW79	S6	RFP
BLW80	S6	RFP
BLW81	S6	RFP
BLW82	S6	RFP
BLW83	S6	RFP
BLW84	S6	RFP
BLW85	S6	RFP
BLW86	S6	RFP
BLW87	S6	RFP
BLW89	S6	RFP
BLW90	S6	RFP
BLW91	S6	RFP
BLW95	S6	RFP
BLW96	S6	RFP
BLW98	S6	RFP
BLX13	S6	RFP
BLX13C	S6	RFP
BLX14	S6	RFP
BLX15	S6	RFP
BLX39	S6	RFP
BLX65	S6	RFP
BLX66	S6	RFP
BLX67	S6	RFP
BLX68	S6	RFP
BLX69A	S6	RFP
BLX91A	S6	RFP
BLX92A	S6	RFP
BLX93A	S6	RFP
BLX94A	S6	RFP
BLX94C	S6	RFP
BLX95	S6	RFP
BLX96	S6	RFP
BLX97	S6	RFP
BLX98	S6	RFP
BLY33	S6	RFP
BLY34	S6	RFP
BLY35	S6	RFP
BLY36	S6	RFP
BLY83	S6	RFP
BLY84	S6	RFP
BLY85	S6	RFP
BLY87A	S6	RFP
BLY87C	S6	RFP

RFP = R.F. power transistors and modules
RT = Tripler
Sm = Small-signal transistors

ThM = Thyristor Modules
WBM = Wideband hybrid IC modules
WBT = Wideband hybrid IC transistors

type no.	book	section
BLY88A	S6	RFP
BLY88C	S6	RFP
BLY89A	S6	RFP
BLY89C	S6	RFP
BLY90	S6	RFP
BLY91A	S6	RFP
BLY91C	S6	RFP
BLY92A	S6	RFP
BLY92C	S6	RFP
BLY93A	S6	RFP
BLY93C	S6	RFP
BLY94	S6	RFP
BLY97	S6	RFP
BPW22A	S8	PDT
BPW44	S8	PDT
BPW45	S8	PDT
BPW50	S8	PDT
BPX25	S8	PDT
BPX29	S8	PDT
BPX40	S8	PDT
BPX41	S8	PDT
BPX42	S8	PDT
BPX47B/18	S8	PDT
BPX47B/20	S8	PDT
BPX47C/36	S8	PDT
BPX70	S8	PDT
BPX71	S8	PDT
BPX72	S8	PDT
BPX95C	S8	PDT
BR100/03	S2	Th
BR101	S3	Sm
BRY39	S3	Sm
BRY56	S3	Sm
BRY61	S7	Mm
BRY62	S7	Mm
BSR12;R	S7	Mm
BSR13;R	S7	Mm
BSR14;R	S7	Mm
BSR15;R	S7	Mm
BSR16;R	S7	Mm
BSR17;R	S7	Mm
BSR17A;R	S7	Mm
BSR18;R	S7	Mm
BSR18A;R	S7	Mm
BSR30	S7	Mm
BSR31	S7	Mm
BSR32	S7	Mm
BSR33	S7	Mm
BSR40	S7	Mm
BSR41	S7	Mm
BSR42	S7	Mm
BSR43	S7	Mm
BSR50	S3	Sm
BSR51	S3	Sm
BSR52	S3	Sm
BSR56	S7	Mm
BSR57	S7	Mm
BSR58	S7	Mm
BSR60	S3	Sm
BSR61	S3	Sm
BSR62	S3	Sm
BSS38	S3	Sm
BSS50	S3	Sm
BSS51	S3	Sm
BSS52	S3	Sm
BSS60	S3	Sm
BSS61	S3	Sm
BSS62	S3	Sm
BSS63;R	S7	Mm
BSS64;R	S7	Mm
BSS68	S3	Sm
BST15	S7	Mm
BST16	S7	Mm
BST50	S7	Mm
BST51	S7	Mm
BST52	S7	Mm
BST60	S7	Mm
BST61	S7	Mm
BST62	S7	Mm
BSV15	S3	Sm
BSV16	S3	Sm
BSV17	S3	Sm
BSV52;R	S7	Mm
BSV64	S3	Sm
BSV78	S5	FET
BSV79	S5	FET
BSV80	S5	FET
BSV81	S5	FET
BSW66A	S3	Sm
BSW67A	S3	Sm
BSW68A	S3	Sm
BSX19	S3	Sm
BSX20	S3	Sm
BSX45	S3	Sm
BSX46	S3	Sm
BSX47	S3	Sm
BSX59	S3	Sm
BSX60	S3	Sm
BSX61	S3	Sm
BSY95A	S3	Sm
BT136*	S2	Tri
BT137*	S2	Tri
BT138*	S2	Tri
BT139*	S2	Tri
BT149*	S2	Th
BT151*	S2	Th
BT152*	S2	Th
BT153	S2	Th
BT154	S2	Th
BT155*	S2	Th
BTV24*	S2	Th
BTV34*	S2	Tri
BTV58*	S2	Th
BTW23*	S2	Th
BTW30S*	S2	Th
BTW31W*	S2	Th
BTW38*	S2	Th
BTW40*	S2	Th
BTW42*	S2	Th
BTW43*	S2	Tri

* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
PDT = Photodiodes or transistors
RFP = R.F. power transistors and modules
Sm = Small-signal transistors
Th = Thyristors
Tri = Triacs

type no.	book	section
BTW45*	S2	Th
BTW47*	S2	Th
BTW58*	S2	Th
BTW63*	S2	Th
BTW92*	S2	Th
BTX18*	S2	Th
BTX94*	S2	Tri
BTY79*	S2	Th
BTY87*	S2	Th
BTY91*	S2	Th
BU208A	S4	P
BU326	S4	P
BU326A	S4	P
BU426	S4	P
BU426A	S4	P
BU433	S4	P
BUS11;A	S4	P
BUS12;A	S4	P
BUS13;A	S4	P
BUS14;A	S4	P
BUV82	S4	P
BUV83	S4	P
BUW84	S4	P
BUW85	S4	P
BUX46;A	S4	P
BUX47;A	S4	P
BUX48;A	S4	P
BUX80	S4	P
BUX81	S4	P
BUX82	S4	P
BUX83	S4	P
BUX84	S4	P
BUX85	S4	P
BUX86	S4	P
BUX87	S4	P
BUX98	S4	P
BUY89	S4	P
BY184	S1	R
BY188G	S1	R
BY223	S2	R
BY224*	S2	R
BY225*	S2	R
BY228	S1	R
BY229*	S2	R
BY249	S2	R
BY260*	S2	R
BY261*	S2	R
BY277*	S2	R
BY438	S1	R
BY448	S1	R
BY458	S1	R
BY476	S1	R
BY477	S1	R
BY478	S1	R
BY505	S1	R
BY509	S1	R
BY527	S1	R
BY584	S1	R
BY609	S1	R
BY610	S1	R
BYV20	S2	R
BYV21*	S2	R
BYV22	S2	R
BYV23	S2	R
BYV24	S2	R
BYV27	S1	R
BYV28	S1	R
BYV30*	S2	R
BYV32*	S2	R
BYV92*	S2	R
BYV95A	S1	R
BYV95B	S1	R
BYV95C	S1	R
BYV96D	S1	R
BYV96E	S1	R
BYW19*	S2	R
BYW25	S2	R
BYW29*	S2	R
BYW30*	S2	R
BYW31*	S2	R
BYW54	S1	R
BYW55	S1	R
BYW56	S1	R
BYW92*	S2	R
BYW93*	S2	R
BYW94*	S2	R
BYW95A	S1	R
BYW95B	S1	R
BYW95C	S1	R
BYW96D	S1	R
BYW96E	S1	R
BYX10	S1	R
BYX22*	S2	R
BYX25*	S2	R
BYX30*	S2	R
BYX32*	S2	R
BYX38*	S2	R
BYX39*	S2	R
BYX42*	S2	R
BYX45*	S2	R
BYX46*	S2	R
BYX49*	S2	R
BYX50*	S2	R
BYX52*	S2	R
BYX56*	S2	R
BYX71*	S2	R
BYX90	S1	R
BYX91*	S1	R
BYX94	S1	R
BYX96*	S2	R
BYX97*	S2	R
BYX98*	S2	R
BYX99*	S2	R
BZT03	S1	Vrg
BZV10	S1	Vrf
BZV11	S1	Vrf
BZV12	S1	Vrf
BZV13	S1	Vrf
BZV14	S1	Vrf
BZV15*	S2	Vrg

* = series
D = Displays
GD = Germanium diodes
LED = Light emitting diodes
Mm = Microminiature semiconductors for hybrid circuits

P = Low-frequency power transistors
Ph = Photoconductive devices
PhC = Photocouplers
R = Rectifier diodes
St = Rectifier stacks

type no.	book	section
BZV37	S1	Vrf
BZV46	S1	Vrg
BZV49*	S1/S7	Vrg
BZV85	S1	Vrg
BZW70*	S2	TS
BZW86*	S2	TS
BZW91*	S2	TS
BZX55	S1	Vrg
BZX70*	S2	Vrg
BZX75	S1	Vrg
BZX79*	S1	Vrg
BZX84*	S7/S1	Mm/Vrg
BZX87*	S1	Vrg
BZX90	S1	Vrf
BZX91	S1	Vrf
BZX92	S1	Vrf
BZX93	S1	Vrf
BZX94	S1	Vrf
BZY91*	S2	Vrg
BZY93*	S2	Vrg
BZY95*	S2	Vrg
BZY96*	S2	Vrg
CNX21	S8	PhC
CNX35	S8	PhC
CNX36	S8	PhC
CNX38	S8	PhC
CNY48	S8	PhC
CNY50	S8	PhC
CNY52	S8	PhC
CNY53	S8	PhC
CNY57	S8	PhC
CNY57A	S8	PhC
CNY62	S8	PhC
CNY63	S8	PhC
CQ209S	S8	D
CQ216X	S8	D
CQ216Y	S8	D
CQ327;R	S8	D
CQ330;R	S8	D
CQ331;R	S8	D
CQ332;R	S8	D
CQ427;R	S8	D
CQ430;R	S8	D
CQ431;R	S8	D
CQ432;R	S8	D
CQL10	S8	LED
CQW10	S8	LED
CQW11	S8	LED
CQW12	S8	LED
CQX10	S8	LED
CQX11	S8	LED
CQX12	S8	LED
CQX51	S8	LED
CQX54	S8	LED
CQX55	S8	LED
CQX56	S8	LED
CQX57	S8	LED
CQX58	S8	LED
CQX60	S8	LED
CQX61	S8	LED
CQX62	S8	LED
CQX63	S8	LED
CQX64	S8	LED
CQX65	S8	LED
CQX66	S8	LED
CQX67	S8	LED
CQX68	S8	LED
CQX74	S8	LED
CQX75	S8	LED
CQX76	S8	LED
CQX77	S8	LED
CQX78	S8	LED
CQY11B	S8	LED
CQY11C	S8	LED
CQY24B	S8	LED
CQY49B	S8	LED
CQY49C	S8	LED
CQY50	S8	LED
CQY52	S8	LED
CQY54	S8	LED
CQY58A	S8	LED
CQY89A	S8	LED
CQY94	S8	LED
CQY95	S8	LED
CQY96	S8	LED
CQY97	S8	LED
OA90	S1	GD
OA91	S1	GD
OA95	S1	GD
OM320	S10	WBM
OM321	S10	WBM
OM322	S10	WBM
OM323	S10	WBM
OM323A	S10	WBM
OM335	S10	WBM
OM336	S10	WBM
OM337	S10	WBM
OM337A	S10	WBM
OM339	S10	WBM
OM345	S10	WBM
OM350	S10	WBM
OM360	S10	WBM
OM361	S10	WBM
OM370	S10	WBM
OM931	S4	P
OM961	S4	P
ORP60	S8	Ph
ORP61	S8	Ph
ORP62	S8	Ph
ORP66	S8	Ph
ORP68	S8	Ph
ORP69	S8	Ph
OSB9110	S2	St
OSB9210	S2	St
OSB9410	S2	St
OSM9110	S2	St
OSM9210	S2	St
OSM9410	S2	St
OSM9510	S2	St
OSM9511	S2	St

Th = Thyristors
Tri = Triacs
TS = Transient suppressor diodes

Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WBM = Wideband hybrid IC modules

type no.	book	section
OSM9512	S2	St
OSS9110	S2	St
OSS9210	S2	St
OSS9410	S2	St
PH2222;R	S3	Sm
PH2222A;R	S3	Sm
PH2369	S3	Sm
PH2907;R	S3	Sm
PH2907A;R	S3	Sm
PH40*	S2	R
PH70*	S2	R
RPY58A	S8	Ph
RPY82	S8	Ph
RPY84	S8	Ph
RPY85	S8	Ph
RPY86	S8	I
RPY87	S8	I
RPY88	S8	I
RPY89	S8	I
RPY90*	S8	I
RPY91*	S8	I
RPY93	S8	I
RPY96	S8	I
1N821;A	S1	Vrf
1N823;A	S1	Vrf
1N825;A	S1	Vrf
1N827;A	S1	Vrf
1N829;A	S1	Vrf
1N914	S1	SD
1N916	S1	SD
1N3879	S2	R
1N3880	S2	R
1N3881	S2	R
1N3882	S2	R
1N3889	S2	R
1N3890	S2	R
1N3891	S2	R
1N3892	S2	R
1N3899	S2	R
1N3900	S2	R
1N3901	S2	R
1N3902	S2	R
1N3903	S2	R
1N3909	S2	R
1N3910	S2	R
1N3911	S2	R
1N3912	S2	R
1N3913	S2	R
1N4001G	S1	R
1N4002G	S1	R
1N4003G	S1	R
1N4004G	S1	R
1N4005G	S1	R
1N4006G	S1	R
1N4007G	S1	R
1N4148	S1	SD
1N4150	S1	SD
1N4151	S1	SD
1N4154	S1	SD
1N4446	S1	SD
1N4448	S1	SD
1N4531	S1	SD
1N4532	S1	SD
1N5059	S1	R
1N5060	S1	R
1N5061	S1	R
1N5062	S1	R
2N918	S10	WBT
2N929	S3	Sm
2N930	S3	Sm
2N1613	S3	Sm
2N1711	S3	Sm
2N1893	S3	Sm
2N2218	S3	Sm
2N2218A	S3	Sm
2N2219	S3	Sm
2N2219A	S3	Sm
2N2221	S3	Sm
2N2221A	S3	Sm
2N2222	S3	Sm
2N2222A	S3	Sm
2N2297	S3	Sm
2N2368	S3	Sm
2N2369	S3	Sm
2N2369A	S3	Sm
2N2483	S3	Sm
2N2484	S3	Sm
2N2904	S3	Sm
2N2904A	S3	Sm
2N2905	S3	Sm
2N2905A	S3	Sm
2N2906	S3	Sm
2N2906A	S3	Sm
2N2907	S3	Sm
2N2907A	S3	Sm
2N3019	S3	Sm
2N3020	S3	Sm
2N3053	S3	Sm
2N3375	S6	RFP
2N3553	S6	RFP
2N3632	S6	RFP
2N3822	S5	FET
2N3823	S5	FET
2N3866	S6	RFP
2N3903	S3	Sm
2N3904	S3	Sm
2N3905	S3	Sm
2N3906	S3	Sm
2N3924	S6	RFP
2N3926	S6	RFP
2N3927	S6	RFP
2N3966	S5	FET
2N4030	S3	Sm
2N4031	S3	Sm
2N4032	S3	Sm
2N4033	S3	Sm
2N4091	S5	FET
2N4092	S5	FET
2N4093	S5	FET
2N4123	S3	Sm

FET = Field-effect transistors
I = Infrared devices
Ph = Photoconductive devices
R = Rectifier diodes
RFP = R.F. power transistors and modules
SD = Small-signal diodes
Sm = Small-signal transistors
St = Rectifier stacks
Vrf = Voltage reference diodes
WBT = Wideband hybrid IC transistors

type no.	book	section
2N4124	S3	Sm
2N4125	S3	Sm
2N4126	S3	Sm
2N4391	S5	FET
2N4392	S5	FET
2N4393	S5	FET
2N4427	S6	RFP
2N4856	S5	FET
2N4857	S5	FET
2N4858	S5	FET
2N4859	S5	FET
2N4860	S5	FET
2N4861	S5	FET
2N5415	S3	Sm
2N5416	S3	Sm
61SV	S8	I
368BPY	S8	PDT
56201d	S4	A
56201j	S4	A
56230	S2	HE
56231	S2	HE
56245	S3,6,10	A
56246	S3,5,10	A
56253	S2	DH
56256	S2	DH
56261a	S4	A
56262A	S2	A
56264A	S2	A
56268	S2	DH
56290	S2	HE
56295	S2	A
56312	S2	DH
56313	S2	DH
56316	S2	A
56317	S2	A
56326	S4	A
56333	S4	A
56339	S4	A
56348	S2	DH
56350	S2	DH
56352	S4	A
56353	S4	A
56354	S4	A
56359b	S4	A
56359c	S4	A
56359d	S4	A
56360a	S4	A
56363	S2,S4	A
56364	S2,S4	A
56366	S2	A
56367	S2,S4	A
56368a	S4	A
56368b	S4	A
56369	S2,S4	A
56378	S4	A
56378	S4	A
56379	S4	A
56387a,b	S4	A

A = Accessories
DH = Diecast heatsinks
FET = Field-effect transistors
HE = Heatsink extrusions

I = Infrared devices
PDT = Photodiodes or transistors
RFP = R.F. power transistors and modules
Sm = Small-signal transistors

GENERAL

Type designation
Rating systems
Letter symbols
s-parameters

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices – as opposed to integrated circuits –, multiples of such devices and semiconductor chips.

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

The first letter gives information about the material used for the active part of the devices.

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15$ °C/W)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15$ °C/W)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15$ °C/W)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15$ °C/W)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15$ °C/W)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15$ °C/W)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15$ °C/W)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15$ °C/W)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter W)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.*
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.*
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

Sub-classification can be used for devices supplied in a wide range of variants called associated types. Following sub-coding suffixes are in use:

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current.rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*
   The NUMBER indicates the rated maximum repetitive peak reverse voltage (V_{RRM}) or the rated repetitive peak off-state voltage (V_{DRM}), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER,* preceded by a hyphen (–)
   The NUMBER indicates the depletion layer in µm. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER,* preceded by a stroke (/).
   The NUMBER indicates how many basic devices are assembled into the array.

→ * When these serial numbers are exhausted the serial number for consumer types may be extended to four figures, and that for industrial types to three figures.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note
This definition excludes inductors, capacitors, resistors and similar components.

Characteristic. A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

Bogey electronic device. An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Rating. A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Note
Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note
The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a	Anode terminal
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
C, c	Collector terminal
D, d	Drain terminal
E, e	Emitter terminal
F, f	Forward
G, g	Gate terminal
K, k	Cathode terminal
M, m	Peak value
O, o	As third subscript: The terminal not mentioned is open circuited
R, r	As first subscript: Reverse. As second subscript: Repetitive. As third subscript: With a specified resistance between the terminal not mentioned and the reference terminal.
(RMS), (rms)	R.M.S. value
S, s	As first or second subscript: Source terminal (for FETS only) As second subscript: Non-repetitive (not for FETS) As third subscript: Short circuit between the terminal not mentioned and the reference terminal
X, x	Specified circuit
Z, z	Replaces R to indicate the actual working voltage, current or power of voltage reference and voltage regulator diodes.

Note: No additional subscript is used for d.c. values.

Upper-case subscripts shall be used for the indication of:

a) continuous (d.c.) values (without signal)

Example I_B

b) instantaneous total values

Example i_B

c) average total values

Example $I_{B(AV)}$

d) peak total values

Example I_{BM}

e) root-mean-square total values

Example $I_{B(RMS)}$

Lower-case subscripts shall be used for the indication of values applying to the varying component alone:

a) instantaneous values

Example i_b

b) root-mean-square values

Example $I_{b(rms)}$

c) peak values

Example I_{bm}

d) average values

Example $I_{b(av)}$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}

Diodes: To indicate a forward current (conventional current flow into the anode terminal) the subscript F or f should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript R or r should be used.

Examples: I_F, I_R, i_F, $I_{f(rms)}$

Subscripts for voltages

Transistors: If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

Examples: V_{BE}, v_{BE}, v_{be}, V_{bem}

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the subscript F or f should be used; for a reverse voltage (anode negative with respect to cathode) the subscript R or r should be used.

Examples: V_F, V_R, v_F, V_{rm}

Subscripts for supply voltages or supply currents

Supply voltages or supply currents shall be indicated by repeating the appropriate terminal subscript.

Examples: V_{CC}, I_{EE}

Note: If it is necessary to indicate a reference terminal, this should be done by a third subscript

Example : V_{CCE}

Subscripts for devices having more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal followed by a number; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{B2} = continuous (d.c.) current flowing into the second base terminal

V_{B2-E} = continuous (d.c.) voltage between the terminals of second base and emitter

Subscripts for multiple devices

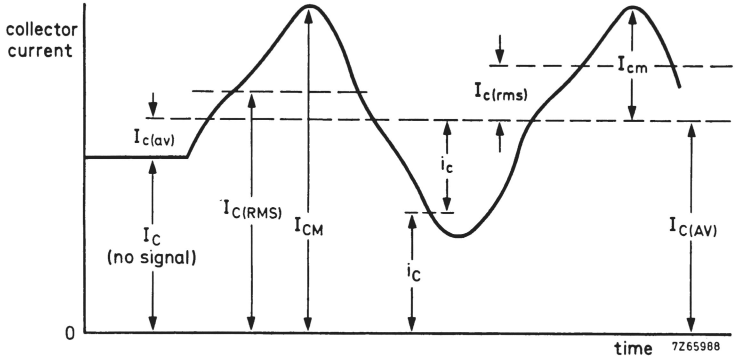
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{2C} = continuous (d.c.) current flowing into the collector terminal of the second unit

V_{1C-2C} = continuous (d.c.) voltage between the collector terminals of the first and the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (d.c.) current and a varying component.



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Definition

For the purpose of this Publication, the term "electrical parameter" applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

Basic letters

The following is a list of the most important basic letters used for electrical parameters of semiconductor devices.

B, b = susceptance; imaginary part of an admittance
C = capacitance
G, g = conductance; real part of an admittance
H, h = hybrid parameter
L = inductance
R, r = resistance; real part of an impedance
X, x = reactance; imaginary part of an impedance
Y, y = admittance;
Z, z = impedance;

Upper-case letters shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

F, f = forward; forward transfer
I, i (or 1) = input
L, 1 = load
O, o (or 2) = output
R, r = reverse; reverse transfer
S, s = source

Examples: Z_S, h_f, h_F

The upper-case variant of a subscript shall be used for the designation of static (d.c.) values.

Examples : h_{FE} = static value of forward current transfer ratio in common-emitter configuration (d.c. current gain)
R_E = d.c. value of the external emitter resistance.

Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript shall be used for the designation of small-signal values.

Examples: h_{fe} = small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration
$Z_e = R_e + jX_e$ = small-signal value of the external impedance

Note: If more than one subscript is used, subscripts for which both styles exist shall either be all upper-case or all lower-case

Examples: h_{FE}, y_{RE}, h_{fe}

Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer

Examples: h_i (or h_{11})
h_o (or h_{22})
h_f (or h_{21})
h_r (or h_{12})

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: h_{fe} (or h_{21e}), h_{FE} (or h_{21E})

Distinction between real and imaginary parts

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

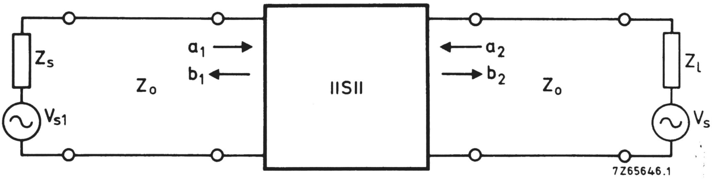
Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

If such symbols do not exist or if they are not suitable, the following notation shall be used:

Examples: Re (h_{ib}) etc. for the real part of h_{ib}
Im (h_{ib}) etc. for the imaginary part of h_{ib}

SCATTERING PARAMETERS

In distinction to the conventional h, y and z-parameters, s-parameters relate to travelling wave conditions. The figure below shows a two-port network with the incident and reflected waves a_1, b_1, a_2 and b_2.



$$a_1 = \frac{V_{i1}}{\sqrt{Z_o}} \qquad a_2 = \frac{V_{i2}}{\sqrt{Z_o}}$$

$$b_1 = \frac{V_{r1}}{\sqrt{Z_o}} \qquad b_2 = \frac{V_{r2}}{\sqrt{Z_o}} \qquad ^{1)}$$

Z_o = characteristic impedance of the transmission line in which the two-port is connected.

V_i = incident voltage

V_r = reflected (generated) voltage

The four-pole equations for s-parameters are:

$$b_1 = s_{11}a_1 + s_{12}a_2$$
$$b_2 = s_{21}a_1 + s_{22}a_2$$

Using the subscripts i for 11, r for 12, f for 21 and o for 22, it follows that:

$$s_i = s_{11} = \left.\frac{b_1}{a_1}\right| a_2 = 0$$
$$s_r = s_{12} = \left.\frac{b_1}{a_2}\right| a_1 = 0$$
$$s_f = s_{21} = \left.\frac{b_2}{a_1}\right| a_2 = 0$$
$$s_o = s_{22} = \left.\frac{b_2}{a_2}\right| a_1 = 0$$

---

1) The squares of these quantities have the dimension of power.

The s-parameters can be named and expressed as follows:

$s_i = s_{11}$ = Input reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the input, under the conditions $Z_l = Z_o$ and $V_{s2} = 0$.

$s_r = s_{12}$ = Reverse transmission coefficient.
The complex ratio of the generated wave at the input and the incident wave at the output, under the conditions $Z_s = Z_o$ and $V_{s1} = 0$.

$s_f = s_{21}$ = Forward transmission coefficient.
The complex ratio of the generated wave at the output and the incident wave at the input, under the conditions $Z_l = Z_o$ and $V_{s2} = 0$

$s_o = s_{22}$ = Output reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the output, under the conditions $Z_s = Z_o$ and $V_{s1} = 0$.

WIDEBAND TRANSISTORS

Type number survey
Selection guide
Soldering recommendations **SOT-37**
Soldering recommendations **SOT-48**
and SOT-122
Accessories

				RATINGS			CHARACTERISTICS (typical values unless otherwise specified)							
	polarity			V_{CEO}	I_C	P_{tot}	f_T	F	at f	G_{UM}	at f	V_o* (d_{im} = −60 dB)	I_C	V_{CE}
	n-p-n	p-n-p	envelope	V	mA	mW	GHz	dB	MHz	dB	MHz	mV	mA	V
BF689K	●		TO-92	15	25	360	1,8	3	200	16	200			
BFG90A	●		SOT-103	15	25	180	5	–	–	18	800			
BFG91A	●		SOT-103	12	35	300	6	–	–	17	800			
BFG96	●		SOT-103	15	150	500	5	–	–	14	800			
BFP90A	●		NO-243	15	30	250	5	2,4	800	19	800			
BFP91A	●		NO-243	12	50	350	6	2,3	800	18	800			
BFP96	●		NO-243	15	100	500	4,5	2,5	800	15	800			
BFQ22	●		TO-72	12	35	150	5	1,9	500	16	500		30	5
BFQ22S	●		TO-72	12	35	150	5	1,9	500	16	500	300	30	5
BFQ23		●	SOT-37	12	35	180	5	2,4	500	16,5	500	300	30	5
BFQ24		●	TO-72	12	35	150	5	2,4	500	15	500	300	30	5
BFQ32		●	SOT-37	15	75	500	4,2	3,75	500	14	500	500	50	10
BFQ33	●		SOT-100	7	20	140	12	2,5	2000	13	2000		14	5
BFQ34	●		SOT-122	18	150	2250	3,9	8	500	16,3	500	1200	120	15
BFQ34T	●		SOT-37	18	150	1000	3,7	–	–	20	300	750	90	10
BFQ51		●	SOT-37	15	25	180	5	2,7	500	19	500	150	14	10
BFQ52		●	TO-72	15	25	150	5	2,7	500	17	500	150	14	10
BFQ53	●		TO-72	15	25	150	5	2,4	500	18	500	150	14	10
BFQ63	●		TO-72	15	75	250	4,5	< 3,0	200	11,5	500	500	50	10
BFQ65	●		SOT-37	10	50	300	7,5	3	2000	8	2000			
BFQ66	●		NO-243	10	50	350	7,5	3	2000	12,5	2000			
BFQ68	●		SOT-122	18	300	4500	4	–	–	13	800	1600	240	15
BFR49	●		SOT-100	15	25	180	5	2,5	1000	17	1000		14	10
BFR64	●		SOT-48	25	200	3500	1	6	200					
BFR65	●		SOT-48	25	400	5000	> 1	–	–					
BFR90	●		SOT-37	15	25	180	5	2,4	500	19,5	500	150	14	10
BFR90A	●		SOT-37	15	25	180	5	1,8	800	20	500	150	14	10
BFR91	●		SOT-37	12	35	180	5	1,9	500	18	500	300	30	5
BFR91A	●		SOT-37	12	35	300	6	1,6	800	14	800	425	30	8
BFR94	●		SOT-48	25	150	3500	3,5	5	500	13,5	500	700	90	20

* Typical reference value.

	polarity			RATINGS			CHARACTERISTICS (typical values unless otherwise specified)							
	n-p-n	p-n-p	envelope	V_{CEO} V	I_C mA	P_{tot} mW	f_T GHz	F dB	at f MHz	G_{UM} dB	at f MHz	V_o* (d_{im} = −60 dB mV	I_C mA	V_{CE} V
BFR95	●		TO-39	25	150	1500	3,5	9	200			1000	80	18
BFR96	●		SOT-37	15	75	500	5	3,3	500	15,2	500	500	50	10
BFR96S	●		SOT-37	15	100	700	5	4	800	11,5	800	700	70	10
BFT24	●		SOT-37	5	2,5	30	2,3	3,8	500	17	500			
BFW16A	●		TO-39	25	150	1500	1,2	<6	200					
BFW17A	●		TO-39	25	150	1500	1,1	—	—					
BFW30	●		TO-72	10	50	250	1,6	<5	500			100	30	6
BFW92	●		SOT-37	15	25	190	1,6	4	500					
BFW92A	●		SOT-37	15	25	200	2,8	2,5	800	13	800	150	14	10
BFW93	●		SOT-37	10	50	190	1,7	<5	500	10,5	800	100	30	5
BFX89	●		TO-72	15	25	200	1,2	3,3	200					
BFY90	●		TO-72	15	25	200	1,4	2,5	200					
2N918	●		TO-72	15	50	200	<0,9	<6	60	36	200			

* Typical reference value.

This table shows the most preferred types of n-p-n transistors and their complements for wideband applications. It shows the types *in sequence of linear output voltage* capability in each type of envelope. The values of V_o are only given as a typical reference.

For detailed information see relevant data sheet.

	polarity		I_C (mA) V_{CE} (V)		14 10	30 5	30 8	50 10	70 10	80 10	90 10	120 15	240 15
envelope	n-p-n	p-n-p	V_o* (mV)		150	300	425	500	700		1000	1200	1600
SOT-37	● ●			BFT24	BFR90 BFR90A	BFR91 BFR91A	BFR91A	BFR96	BFR96S		BFQ34T		
		●			BFQ51	BFQ23		BFQ32					
SOT-23	● ●			BFT25	BFR92 BFR92A	BFR93 BFR93A	BFR93A						
		●			BFT92	BFT93							
SOT-89	●							BFQ19		BFQ18A			
SOT-122	●											BFQ34	BFQ68
TO-72	●				BFQ53	BFQ22S		BFQ63					
		●			BFQ52	BFQ24							
NEW TYPES (f_T: 5 GHz)													
SOT-103	●				BFG90A	BFG91A	BFG91A		BFG96				
NO-243	●				BFP90A	BFP91A		BFP96					
NEW TYPES (f_T: 7,5 GHz)													
SOT-37	●				BFQ65								
NO-243	●				BFQ66								
SOT-23	●				BFQ67								

* Typical output voltage at d_{im} = –60 dB (DIN 45004B, par. 6.3: 3-tone).

SOLDERING RECOMMENDATIONS SOT-37

Transistors in SOT-37 envelopes may be mounted with leads flat (Fig. 1) or bent (Figs 2 and 3). Different soldering procedures apply for the different styles of mounting.

FLAT-LEAD MOUNTING

Soldering by hand

Avoid putting any force on the leads during or just after soldering.

Solder the three leads one at a time, *not* simultaneously.

Proceed from one lead to the adjacent lead, *not* to the opposite one.

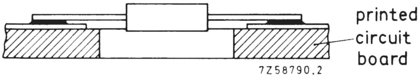


Fig. 1

Solder temperature	max.	300 °C
Soldering time	max.	5 s
Solder-to-case distance	min.	2 mm

BENT-LEAD MOUNTING

If leads are bent, all three may be soldered simultaneously if desired.

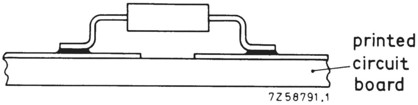


Fig. 2

Solder temperature	max.	300 °C
Soldering time	max.	10 s

DIP OR WAVE SOLDERING

When dip or wave soldering, the maximum allowable temperature of the solder is 260 °C. This temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted up to the lead projections, but the temperature of the body must not exceed the specified storage maximum.

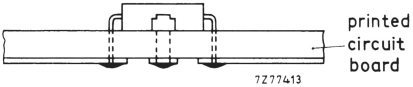


Fig. 3

Solder temperature	max.	260 °C
Soldering time	max.	5 s

RECOMMENDATIONS FOR MOUNTING ¼" CAPSTAN ENVELOPES

A brass nut is supplied with each transistor for securing it to a heatsink.

Screw thread, diameter and nuts:

stud diameter	thread	maximum diameter of threaded stud	nut thickness
¼"	8-32UNC-2A(B)	4,14 mm	3,5 mm SOT-48 5,0 mm SOT-122

To ensure optimum heat transfer and to avoid damage to the threaded stud of the transistor the following recommendations should be observed:

1. Diameter of the mounting hole in the heatsink 4,15 + 0,05; –0 mm (max. 4,2 mm).
2. Heatsink surfaces at the mounting hole to be flat, parallel, and free of burrs or oxydation.
3. Torque on nut: minimum 0,75 Nm (7,5 kgcm), maximum 0,85 Nm (8,5 kgcm).
4. Recommended distance from the top surface of the heatsink to surface of printed-circuit board: 2,9 + 0; –0,2 mm.

Tension in the transistor leads sets the limit on spacing between heatsink and printed-circuit board; in general, the leads can withstand more pull in the downward direction than in the upward direction.

Solder the leads to the connection pads with resin-cored tin-lead solder, using an iron of normal temperature. Soldering iron temperatures as high as 350 °C are safely tolerable; the transistor can withstand an interior temperature of 250 °C for about ten minutes.

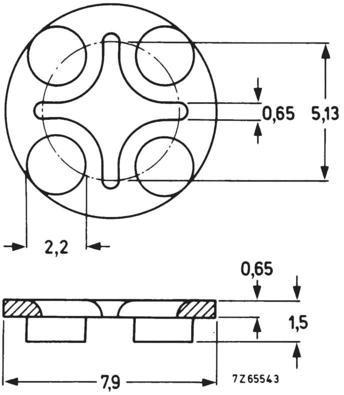
The leads may be tinned, if required, by dipping them into a solder bath at about 230 °C; each lead may be dipped up to its full length. A flux of the quality of Super-Safe is recommended; after tinning, surplus flux should be rinsed away with tap water.

DISTANCE DISCS

MECHANICAL DATA Dimensions in mm

Fig. 1 **56245** for **TO-5** or **TO-39.**

Insulating material;

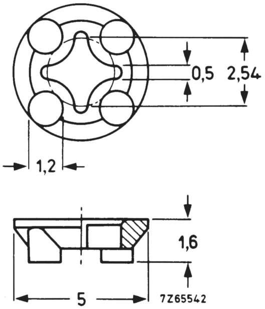

0,65
5,13
2,2
0,65
1,5
7,9
7Z65543

TEMPERATURE

Maximum permissible temperature T max. 100 °C

Fig. 2 **56246** for **TO-18** or **TO-72.**

Insulating material.


0,5
2,54
1,2
1,6
5
7Z65542

TEMPERATURE

Maximum permissible temperature T max. 100 °C

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-92 envelope intended for application as an amplifier or oscillator in the v.h.f. and u.h.f. range.

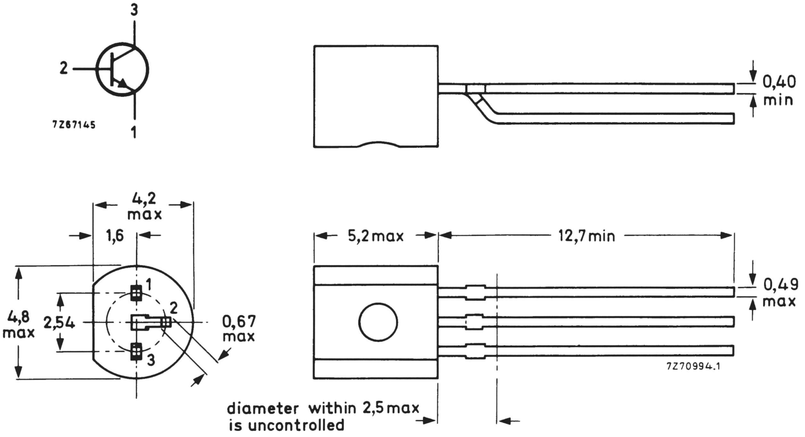
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	360	mW
D.C. current gain				
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	20	
I_C = 20 mA; V_{CE} = 5 V		35 to	70	
Transition frequency at f = 500 MHz				
I_C = 15 mA; V_{CE} = 5 V	f_T	typ.	1,8	GHz

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-92 variant.


3
2
1
7Z67145
0,40
min
4,2
max
1,6
4,8
max
2,54
1
2
3
0,67
max
5,2 max
12,7 min
0,49
max
7Z70994.1
diameter within 2,5 max
is uncontrolled

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage				
$R_{BE} \leqslant 50\ \Omega$	V_{CER}	max.	25	V
$I_B = 0$	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current				
average	I_{CAV}	max.	25	mA
peak value; $t_{on} < 1\ \mu s$	I_{CM}	max.	50	mA
Total power dissipation up to $T_{amb} = 60\ ^oC$	P_{tot}	max.	360	mW
Junction temperature	T_j	max.	150	°C
Storage temperature	T_{stg}	−55 to	+150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	max.	250	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$V_{CB} = 15$ V; $I_E = 0$	I_{CBO}	max.	50	nA
Emitter cut-off current				
$V_{EB} = 2$ V; $I_C = 0$	I_{EBO}	max.	1	μA
Saturation voltages				
$I_C = 25$ mA; $I_B = 1,25$ mA	V_{CEsat}	max.	1	V
	V_{BEsat}	max.	1	V
D.C. current gain				
$I_C = 2$ mA; $V_{CE} = 5$ V	h_{FE}	min.	20	
$I_C = 20$ mA; $V_{CE} = 5$ V		35 to	70	
Transition frequency at f = 500 MHz				
$I_C = 15$ mA; $V_{CE} = 5$ V	f_T	typ.	1,8	GHz
Feedback capacitance				
$I_C = 2$ mA; $V_{CE} = 5$ V	C_{re}	typ.	1,1	pF
Noise figure at f = 100 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 60\ \Omega$	F	typ.	4	dB
Noise figure at f = 200 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 60\ \Omega$	F	typ.	3	dB
Power gain at f = 100 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 60\ \Omega$; $R_L = 2\ k\Omega$	G_P	typ.	16	dB
Power gain at f = 200 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 60\ \Omega$; $R_L = 920\ \Omega$	G_P	typ.	16	dB

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a four-lead, dual emitter plastic envelope.

This device is designed for application in high gain broadband systems up to 1 GHz.

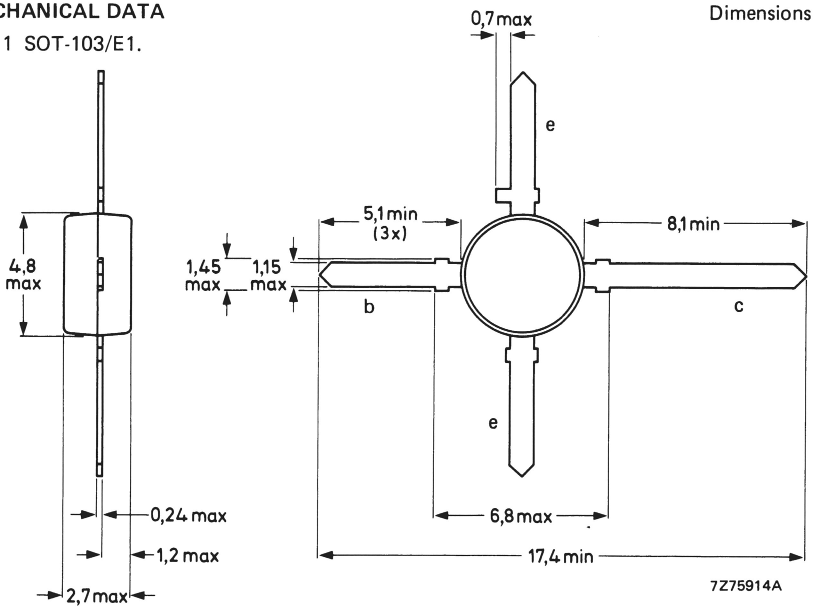
QUICK REFERENCE DATA

Collector-base voltage	V_{CBO}	max.	20	V
Collector-emitter voltage	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 14 mA; V_{CE} = 10 V	h_{FE}	min. typ.	40 90	
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5,0	GHz
Maximum unilateral power gain at f = 800 MHz I_C = 14 mA; V_{CE} = 10 V	G_{UM}	typ.	18	dB

MECHANICAL DATA

Fig. 1 SOT-103/E1.

Dimensions in mm



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C mounted on a p.c.b. of 40 mm x 25 mm x 1 mm and Cu-layer thickness of 35 μm	P_{tot}	max.	180	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient mounted on a p.c.b. of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$		500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	50	nA
D.C. current gain $I_C = 14$ mA; $V_{CE} = 10$ V	h_{FE}	min. typ.	40 90	
Transition frequency at f = 500 MHz $I_E = 14$ mA; $V_{CE} = 10$ V	f_T	typ.	5,0	GHz
Collector output capacitance $I_E = i_e = 0$; $V_{CB} = 10$ V	C_{oe}	typ.	0,7	pF
Collector feedback capacitance $I_E = 0$; $V_{CB} = 10$ V	C_{re}	typ.	0,35	pF

Maximum unilateral power gain at f = 800 MHz

$$G_{UM}\ \text{(in dB)} = 10 \log \frac{|s_{fe}|^2}{[1 - |s_{ie}|^2][1 - |s_{oe}|^2]}$$

$I_E = 14$ mA; $V_{CE} = 10$ V	G_{UM}	typ.	18	dB

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a four-lead, dual emitter plastic envelope.

This device is designed for application in high gain broadband systems up to 1 GHz.

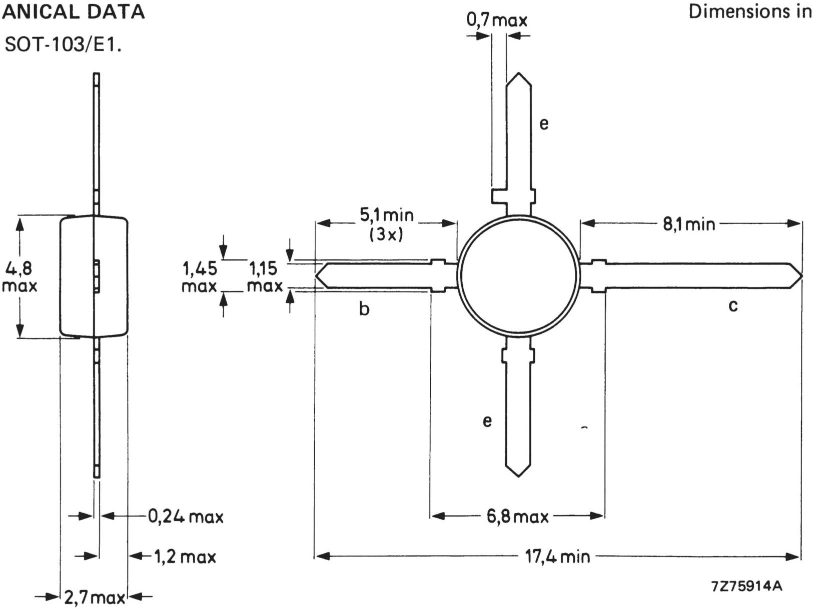
QUICK REFERENCE DATA

Collector-base voltage	V_{CBO}	max.	15 V
Collector-emitter voltage	V_{CEO}	max.	12 V
Collector current (d.c.)	I_C	max.	35 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
D.C. current gain I_C = 30 mA; V_{CE} = 5 V	h_{FE}	min. typ.	40 90
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	6,0 GHz
Maximum unilateral power gain at f = 800 MHz I_C = 30 mA; V_{CE} = 8 V	G_{UM}	typ.	17 dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103/E1.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	15 V
Collector-emitter voltage (open base)	V_{CEO}	max.	12 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0 V
Collector current (d.c.)	I_C	max.	35 mA
Total power dissipation up to T_{amb} = 60 °C mounted on a p.c.b. of 40 mm x 25 mm x 1 mm and Cu-layer thickness of 35 μm	P_{tot}	max.	300 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient mounted on a p.c.b. of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$		300 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	max.	50 nA
D.C. current gain $I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	min. typ.	40 90
Transition frequency at f = 500 MHz $I_E = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	6,0 GHz
Collector output capacitance $I_E = i_e = 0$; $V_{CB} = 10$ V	C_{oe}	typ.	1,0 pF
Collector feedback capacitance $I_E = 0$; $V_{CB} = 5$ V	C_{re}	typ.	0,6 pF

Maximum unilateral power gain at f = 800 MHz

$$G_{UM}\text{ (in dB)} = 10\log\frac{|s_{fe}|^2}{[1-|s_{ie}|^2][1-|s_{oe}|^2]}$$

$I_E = 30$ mA; $V_{CE} = 8$ V	G_{UM}	typ.	17 dB

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a four-lead, dual emitter plastic envelope.

This device is designed for application in high gain broadband systems up to 1 GHz.

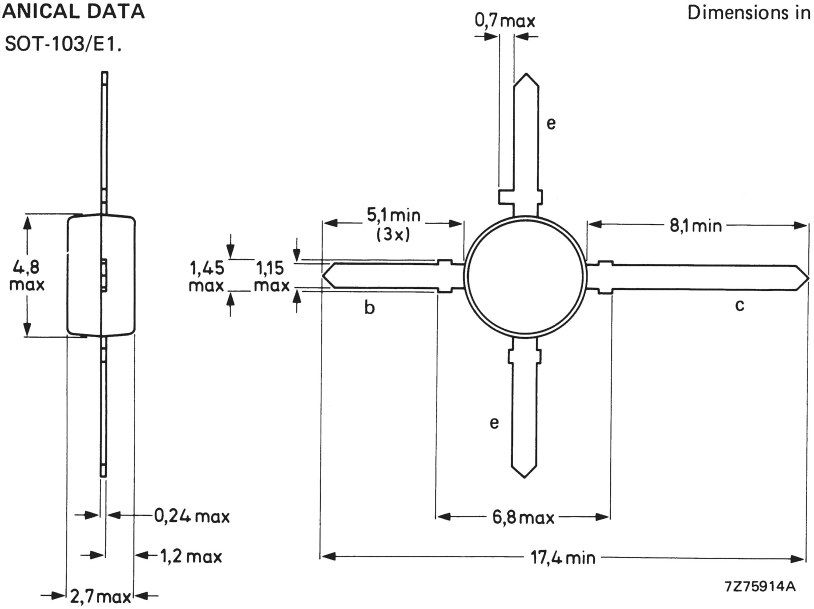
QUICK REFERENCE DATA

Collector-base voltage	V_{CBO}	max.	20	V
Collector-emitter voltage	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	500	mW
Junction temperature	T_j	max.	175	°C
D.C. current gain I_C = 50 mA; V_{CE} = 10 V	h_{FE}	min. typ.	25 50	
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	5,0	GHz
Maximum unilateral power gain at f = 800 MHz I_C = 50 mA; V_{CE} = 10 V	G_{UM}	typ.	14	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103/E1.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,0 V
Collector current (d.c.)	I_C	max.	150 mA
Total power dissipation up to T_{amb} = 60 °C mounted on a p.c.b. of 40 mm x 25 mm x 1,5 mm and Cu-layer thickness of 35 μm	P_{tot}	max.	500 mW
Storage temperature	T_{stg}		−65 to + 175 °C
Junction temperature	T_j	max.	175 °C

THERMAL RESISTANCE

From junction to ambient mounted on a p.c.b. of 40 mm x 25 mm x 1,5 mm	$R_{th\ j\text{-}a}$		230 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	100 nA
D.C. current gain $I_C = 50$ mA; $V_{CE} = 10$ V	h_{FE}	min. typ.	25 50
Transition frequency at f = 500 MHz $I_E = 50$ mA; $V_{CE} = 10$ V	f_T	typ.	5,0 GHz
Collector output capacitance $I_E = i_e = 0$; $V_{CB} = 10$ V	C_{oe}	typ.	1,5 pF
Collector feedback capacitance $I_E = 0$; $V_{CB} = 10$ V	C_{re}	typ.	1,0 pF

Maximum unilateral power gain at f = 800 MHz

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{[1 - |s_{ie}|^2]\,[1 - |s_{oe}|^2]}$$

$I_E = 50$ mA; $V_{CE} = 10$ V	G_{UM}	typ.	14 dB

DEVELOPMENT SAMPLE DATA
This information is derived from development samples made available for evaluation. It does not necessarily imply that the device will go into regular production.

SILICON PLANAR EPITAXIAL TRANSISTOR

Gold-metallized n-p-n transistor in a sub-miniature HERMETICALLY SEALED micro-stripline envelope. The BFP90A features low noise, high gain and low distortion figures.

This device is designed for v.h.f. and u.h.f. wideband amplifiers and applications in the GHz range.

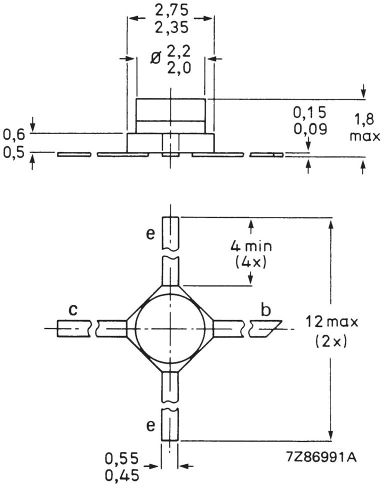
QUICK REFERENCE DATA

Collector-base voltage	V_{CBO}	max.	20 V
Collector-emitter voltage	V_{CEO}	max.	15 V
Collector current (d.c.)	I_C	max.	30 mA
Total power dissipation up to T_{amb} = 125 °C	P_{tot}	max.	250 mW
Junction temperature	T_j	max.	175 °C
D.C. current gain I_C = 14 mA; V_{CE} = 10 V	h_{FE}	min. typ.	40 90
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5,0 GHz
Maximum unilateral power gain I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C at f = 500 MHz at f = 800 MHz	G_{UM}	typ. typ.	24 dB 19 dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 NO-243.



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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Collector current (d.c.)	I_C	max.	30	mA
Total power dissipation up to T_{amb} = 125 °C mounted on a ceramic substrate of 0,7 mm x 10 cm^2	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to +150		°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm^2	$R_{th\ j\text{-}a}$		200	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	50	nA
D.C. current gain $I_C = 14$ mA; $V_{CE} = 10$ V	h_{FE}	min. typ.	40 90	
Transition frequency at f = 500 MHz $I_C = 14$ mA; $V_{CE} = 10$ V	f_T	typ.	5,0	GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0,6	pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ \text{(in dB)} = 10 \log \frac{|s_{fe}|^2}{[1 - |s_{ie}|^2]\ [1 - |s_{oe}|^2]}$$

at $I_C = 14$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C f = 500 MHz f = 800 MHz	G_{UM}	typ. typ.	24 19	dB dB
Noise figure at f = 800 MHz; R_S = opt.; $T_{amb} = 25$ °C $I_C = 4$ mA; $V_{CE} = 10$ V $I_C = 14$ mA; $V_{CE} = 10$ V	F	typ. typ.	1,7 2,4	dB dB

SILICON PLANAR EPITAXIAL TRANSISTOR

Gold-metallized n-p-n transistor in a sub-miniature HERMETICALLY SEALED micro-stripline envelope. The BFP91A features low noise, high gain and low distortion figures.

This device is designed for v.h.f. and u.h.f. wideband amplifiers and applications in the GHz range.

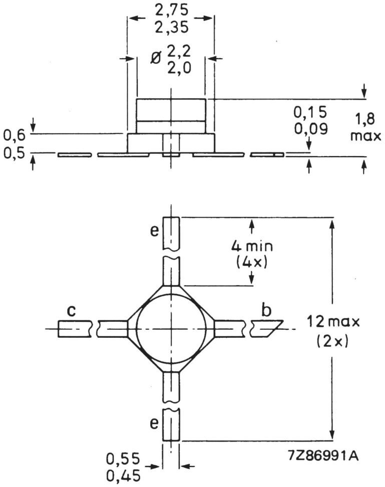
QUICK REFERENCE DATA

Collector-base voltage	V_{CBO}	max.	15	V
Collector-emitter voltage	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 105 °C	P_{tot}	max.	350	mW
Junction temperature	T_j	max.	175	°C
D.C. current gain I_C = 30 mA; V_{CE} = 5 V	h_{FE}	min. typ.	40 90	
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	6,0	GHz
Maximum unilateral power gain I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C at f = 500 MHz at f = 800 MHz	G_{UM}	typ. typ.	22 18	dB dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 NO-243.



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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 105 °C mounted on a ceramic substrate of 0,7 mm x 10 cm^2	P_{tot}	max.	350	mW
Storage temperature	T_{stg}	−65 to	+150	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm^2	$R_{th\ j\text{-}a}$	200	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	50	nA
D.C. current gain $I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	min. typ.	40 90	
Transition frequency at f = 500 MHz $I_C = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	6,0	GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0,7	pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{[1 - |s_{ie}|^2]\ [1 - |s_{oe}|^2]}$$

at $I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C f = 500 MHz f = 800 MHz	G_{UM}	typ. typ.	22 18	dB dB
Noise figure at f = 800 MHz; R_S = opt.; $T_{amb} = 25$ °C $I_C = 4$ mA; $V_{CE} = 8$ V $I_C = 30$ mA; $V_{CE} = 8$ V	F	typ. typ.	1,6 2,3	dB dB

SILICON PLANAR EPITAXIAL TRANSISTOR

Gold-metallized n-p-n transistor in a sub-miniature HERMETICALLY SEALED microstripline envelope. The BFP96 features low noise, high gain and low distortion figures.

This device is designed for v.h.f. and u.h.f. wideband amplifiers and applications in the GHz range.

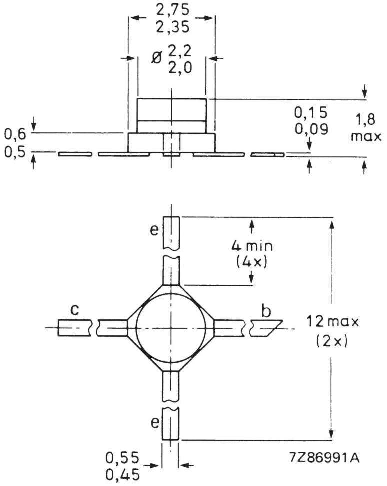
QUICK REFERENCE DATA

Collector-base voltage	V_{CBO}	max.	20	V
Collector-emitter voltage	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 75 °C	P_{tot}	max.	500	mW
Junction temperature	T_j	max.	175	°C
D.C. current gain I_C = 50 mA; V_{CE} = 10 V	h_{FE}	min.	25	
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	4,5	GHz
Maximum unilateral power gain I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C at f = 500 MHz	G_{UM}	typ.	19	dB
at f = 800 MHz		typ.	15	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 NO-243.



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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,0	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 75 °C mounted on a ceramic substrate of 0,7 mm x 10 cm^2	P_{tot}	max.	500	mW
Storage temperature	T_{stg}	−65 to +150		°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm^2	$R_{th\ j\text{-}a}$		200	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 10 V	I_{CBO}	max.	100	nA
D.C. current gain I_C = 50 mA; V_{CE} = 10 V	h_{FE}	min.	25	
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	4,5	GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; V_{CB} = 10 V	C_c	typ.	1,4	pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{[1 - |s_{ie}|^2]\ [1 - |s_{oe}|^2]}$$

at I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C f = 500 MHz f = 800 MHz	G_{UM}	 typ. typ.	 19 15	 dB dB
Noise figure at f = 800 MHz; R_S = opt.; T_{amb} = 25 °C I_C = 10 mA; V_{CE} = 10 V	F	typ.	2,5	dB

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

P-N-P complement is BFQ24.

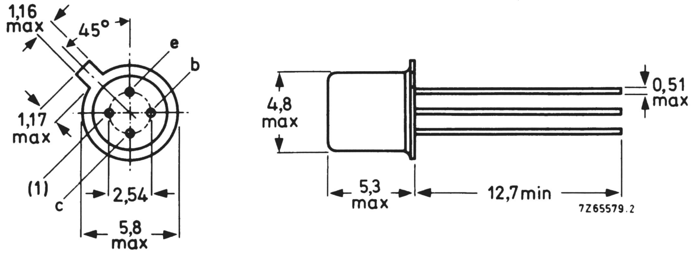
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V	C_{re}	typ.	0,7	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
Maximum unilateral power gain (see page 2) I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	16,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	15 V
Collector-emitter voltage (open base)	V_{CEO}	max.	12 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2 V
Collector current (d.c.)	I_C	max.	35 mA
Collector current (peak value) at $f > 1$ MHz	I_{CM}	max.	50 mA
Total power dissipation up to $T_{amb} = 65$ °C	P_{tot}	max.	150 mW
Storage temperature	T_{stg}		−65 to +200 °C
Junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,9 K/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,6 K/mW

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	$<$	50 nA
D.C. current gain (note 1) $I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	$>$ typ.	25 50
Transition frequency (notes 1 and 2) $I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	5 GHz
Collector capacitance (note 2) $I_E = I_e = 0$; $V_{CB} = 5$ V; f = 1 MHz	C_c	typ.	1,1 pF
Emitter capacitance $I_C = I_c = 0$; $V_{EB} = 0{,}5$ V; f = 1 MHz	C_e	typ.	2,5 pF
Feedback capacitance (note 2) $I_C = 0$; $V_{CE} = 5$ V; f = 1 MHz; $T_{amb} = 25$ °C	C_{re}	typ.	0,7 pF
Noise figure at optimum source impedance (note 2) $I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	1,9 dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	16,0 dB

Notes
1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

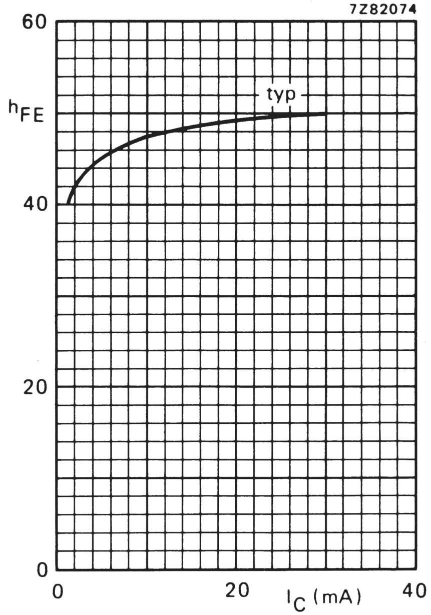


Fig. 2 V_{CE} = 5 V; T_j = 25 °C.

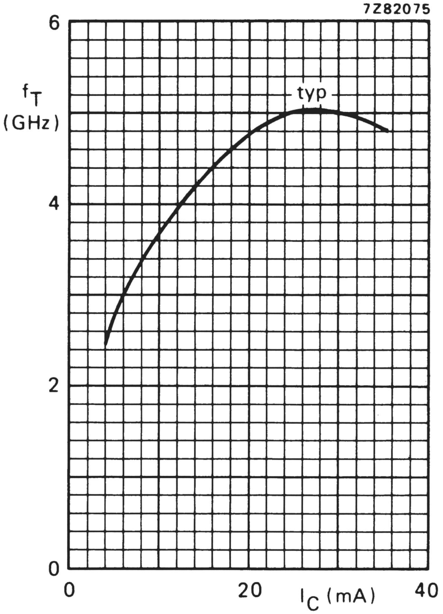


Fig. 3 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

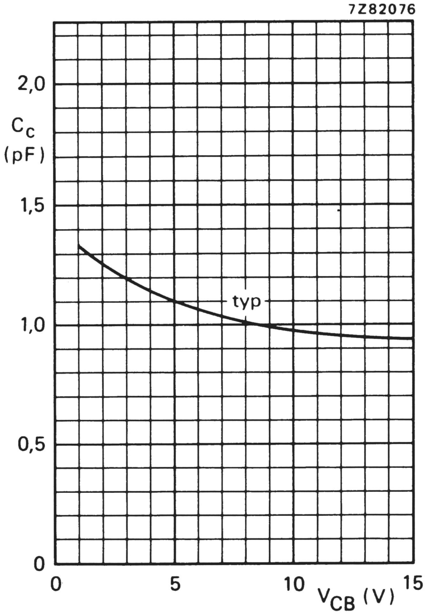


Fig. 4 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor has extremely high power gain and good low noise performance.

P-N-P complement is BFQ24.

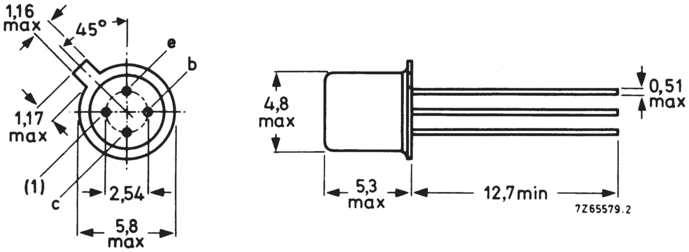
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V	C_{re}	typ.	0,65	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
Maximum unilateral power gain (see page 2) I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	16,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) Shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	35	mA
Collector current (peak value) at $f > 1$ MHz	I_{CM}	max.	50	mA
Total power dissipation up to $T_{amb} = 65$ °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}		−65 to + 200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE (note 1)

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	900	K/W
From junction to case	$R_{th\ j\text{-}c}$	=	600	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50	nA
D.C. current gain (note 2)				
$I_C = 10$ mA; $V_{CE} = 5$ V	h_{FE}		50 to 150	
Transition frequency (notes 2 and 3)				
$I_C = 30$ mA; $V_{CE} = 5$ V; $f = 500$ MHz	f_T	typ.	5	GHz
Feedback capacitance (note 3)				
$I_C = 0$; $V_{CE} = 5$ V; $f = 1$ MHz; $T_{amb} = 25$ °C	C_{re}	typ.	0,65	pF
Noise figure at optimum source impedance (note 3)				
$I_C = 2$ mA; $V_{CE} = 5$ V; $f = 500$ MHz; $T_{amb} = 25$ °C	F	typ.	1,9	dB
$I_C = 10$ mA; $V_{CE} = 5$ V; $f = 200$ MHz; $T_{amb} = 25$ °C	F	<	2,5	dB

Maximum unilateral power gain (note 3)

s_{re} assumed to be zero

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 10$ mA; $V_{CE} = 5$ V; $f = 200$ MHz; $T_{amb} = 25$ °C	G_{UM}	>	21,0	dB
$I_C = 30$ mA; $V_{CE} = 5$ V; $f = 500$ MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	16,0	dB

Notes

1. K/W is SI unit for °C/W.
2. Measured under pulse conditions.
3. Shield lead grounded.

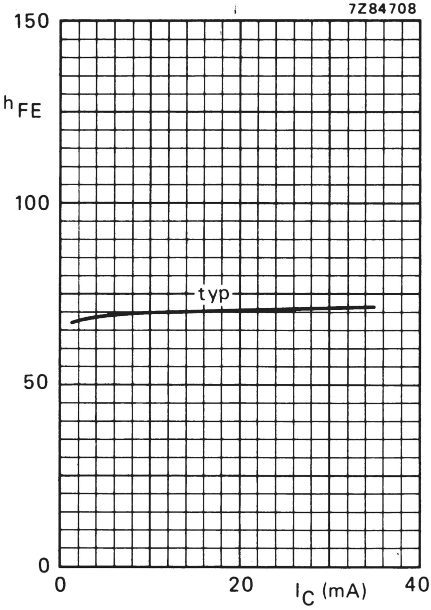


Fig. 2.

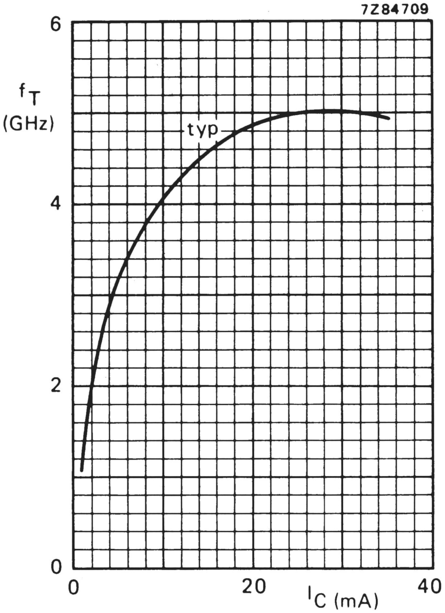


Fig. 3.

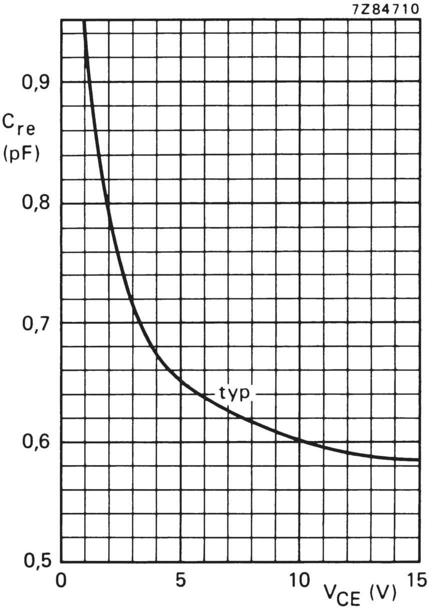


Fig. 4.

Conditions for Figs 2, 3 and 4:

Fig. 2 V_{CE} = 5 V; T_j = 25 °C.

Fig. 3 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

Fig. 4 I_C = 0; f = 1 MHz; T_{amb} = 25 °C; shield lead grounded.

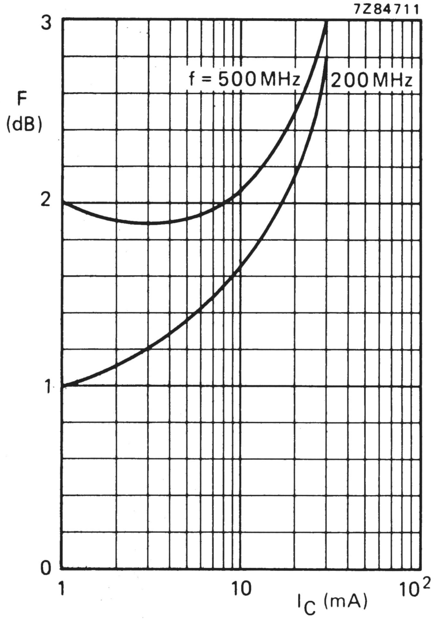


Fig. 5 V_{CE} = 5 V; Z_S = optimum; T_{amb} = 25 °C; typical values; shield lead grounded.

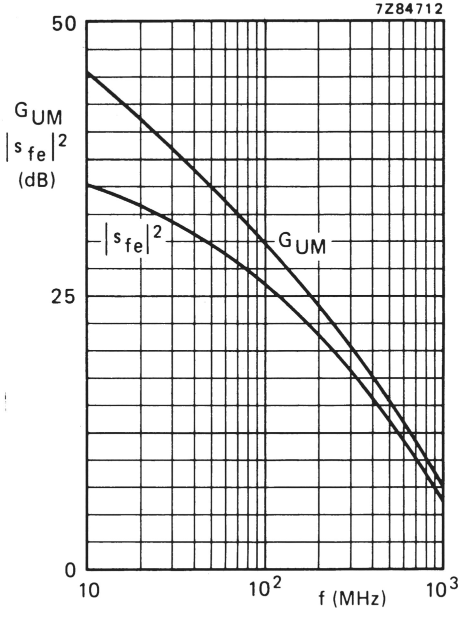


Fig. 6 V_{CE} = 5 V; I_C = 30 mA; T_{amb} = 25 °C; typical values; shield lead grounded.

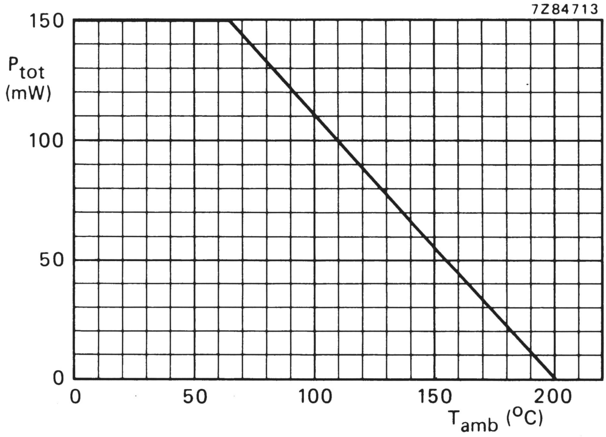


Fig. 7 Power derating curve versus ambient temperature.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a subminiature plastic transfer-moulded T-package. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

N-P-N complements are BFR91 and BFR91A.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Total power dissipation up to T_{amb} = 60 ^oC	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	^oC
Transition frequency at f = 500 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 500 MHz	F	typ.	2,4	dB

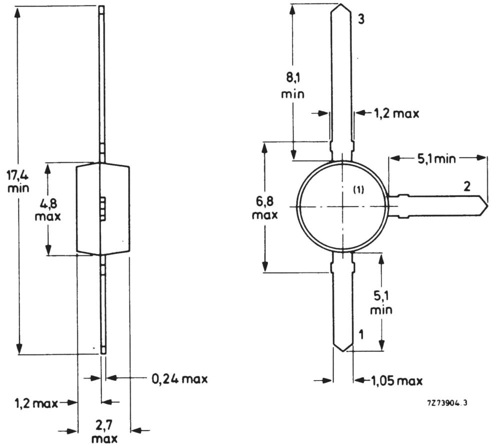
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2 V
Collector current (d.c.)	$-I_C$	max.	35 mA
Collector current (peak value) at f > 1 MHz	$-I_{CM}$	max.	50 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−65 to + 150	°C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0,5 °C/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 5$ V	$-I_{CBO}$	<	50 nA	
D.C. current gain $-I_C = 30$ mA; $-V_{CE} = 5$ V	h_{FE}	>	20	*
Transition frequency f = 500 MHz; $-I_C = 30$ mA; $-V_{CE} = 5$ V	f_T	typ.	5 GHz	*
Collector capacitance f = 1 MHz; $I_E = I_e = 0$; $-V_{CB} = 5$ V	C_c	typ.	0,85 pF	
Emitter capacitance f = 1 MHz; $I_C = I_c = 0$; $-V_{EB} = 0{,}5$ V	C_e	typ.	1,8 pF	
Feedback capacitance f = 1 MHz; $-I_C = 2$ mA; $-V_{CE} = 5$ V	C_{re}	typ.	0,8 pF	
Noise figure at optimum source impedance $-I_C = 2$ mA; $-V_{CE} = 5$ V; f = 500 MHz	F	typ.	2,4 dB	

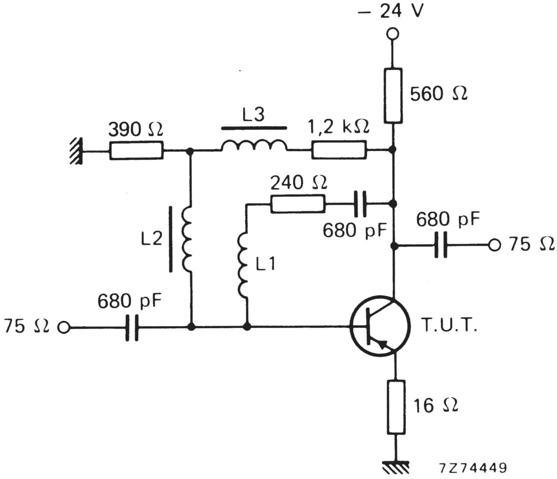
Maximum unilateral power gain
s_{re} assumed to be zero
$-I_C = 30$ mA; $-V_{CE} = 5$ V; f = 500 MHz

$$10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)} = G_{UM} \quad \text{typ.} \quad 16{,}5 \text{ dB}$$

---

* Measured under pulse conditions.

Intermodulation distortion* (see Fig. 2)
$-I_C = 30$ mA; $-V_{CE} = 5$ V; $R_L = 75\ \Omega$; VSWR < 2
$V_p = V_o = 300$ mV at $f_p = 495{,}25$ MHz
$V_q = V_o - 6$ dB at $f_q = 503{,}25$ MHz
$V_r = V_o - 6$ dB at $f_r = 505{,}25$ MHz
Measured at $f_{(p+q-r)} = 493{,}25$ MHz d_{im} typ. -60 dB


– 24 V
560 Ω
390 Ω
L3
1,2 kΩ
240 Ω
680 pF
680 pF
L2
L1
680 pF
75 Ω
75 Ω
T.U.T.
16 Ω
7Z74449

L1: 4 turns Cu wire (0,35); winding pitch 1 mm; internal diameter 4 mm.
L2 and L3: 5 μH (code number 3122 108 20150)

Fig. 2 Intermodulation distortion test circuit.

---

* Measured under pulse conditions.

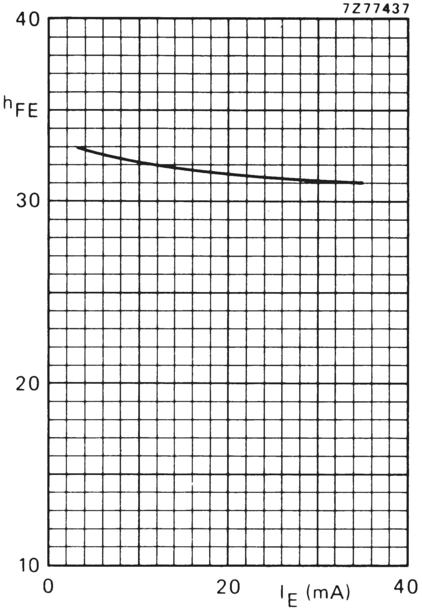


Fig. 3 Typical values; V_{CB} = 4 V.

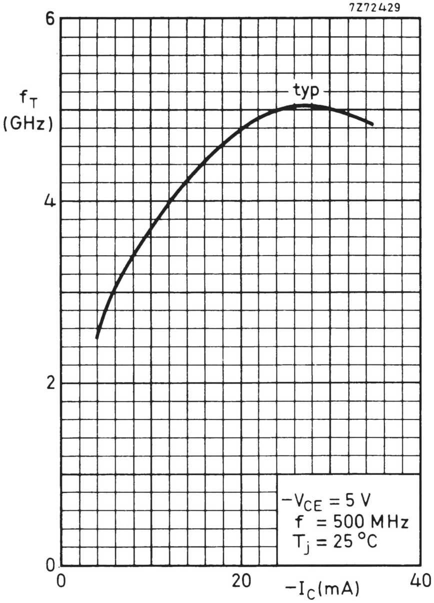


Fig. 4.

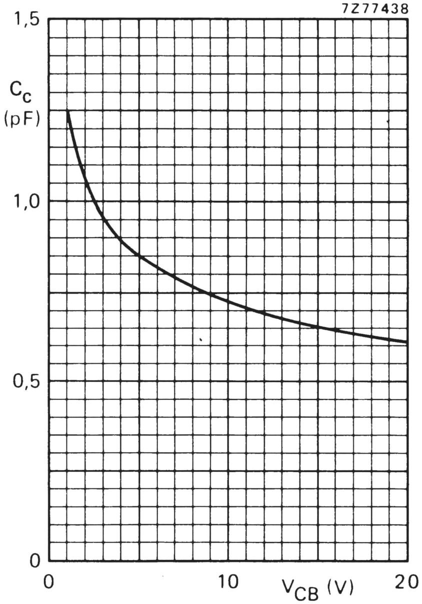


Fig. 5 Typical values; f = 1 MHz.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

N-P-N complement is BFQ22S.

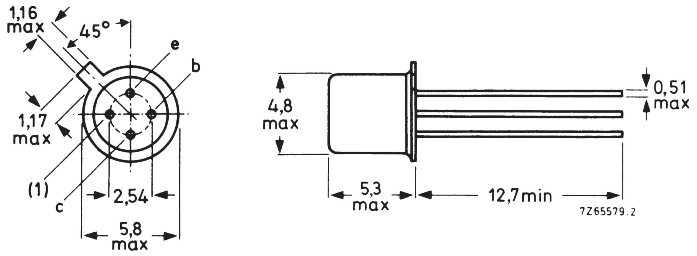
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4	dB
Maximum unilateral power gain (see page 2) $-I_C$ = 30 mA; $-V_{CE}$ = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	15,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	15	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	12	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	35	mA
Collector current (peak value) at $f > 1$ MHz	$-I_{CM}$	max.	50	mA
Total power dissipation up to $T_{amb} = 65$ °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,9	K/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,6	K/mW

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 5$ V	$-I_{CBO}$	<	50	nA
D.C. current gain (note 1) $-I_C = 30$ mA; $-V_{CE} = 5$ V	h_{FE}	> typ.	20 50	
Transition frequency (notes 1 and 2) $-I_C = 30$ mA; $-V_{CE} = 5$ V; $f = 500$ MHz	f_T	typ.	5	GHz
Collector capacitance (note 3) $I_E = I_e = 0$; $-V_{CB} = 5$ V; $f = 1$ MHz	C_c	typ.	1,2	pF
Emitter capacitance $I_C = I_c = 0$; $-V_{EB} = 0,5$ V; $f = 1$ MHz	C_e	typ.	2,5	pF
Feedback capacitance (note 2) $I_C = 0$; $-V_{CE} = 5$ V; $f = 1$ MHz; $T_{amb} = 25$ °C	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance (note 2) $-I_C = 2$ mA; $-V_{CE} = 5$ V; $f = 500$ MHz; $T_{amb} = 25$ °C	F	typ.	2,4	dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$-I_C = 30$ mA; $-V_{CE} = 5$ V; $f = 500$ MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	15,0	dB

Notes

1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

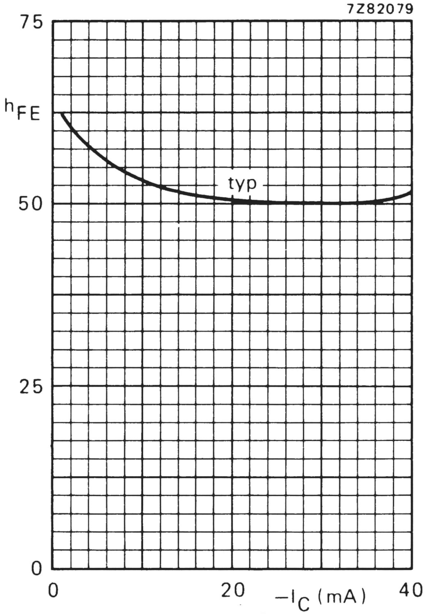


Fig. 2 $-V_{CE} = 5$ V; $T_j = 25$ °C.

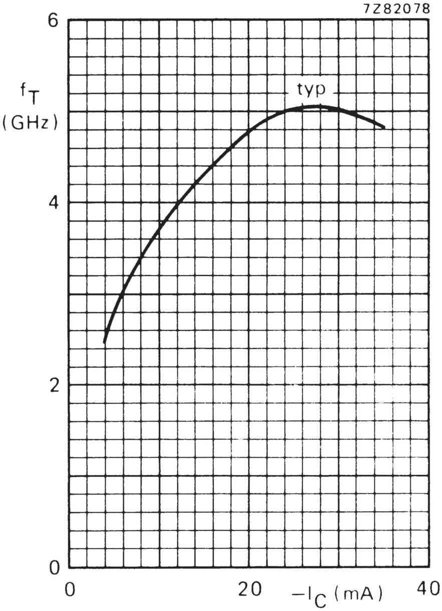


Fig. 3 $-V_{CE} = 5$ V; f = 500 MHz; $T_j = 25$ °C; shield lead grounded.

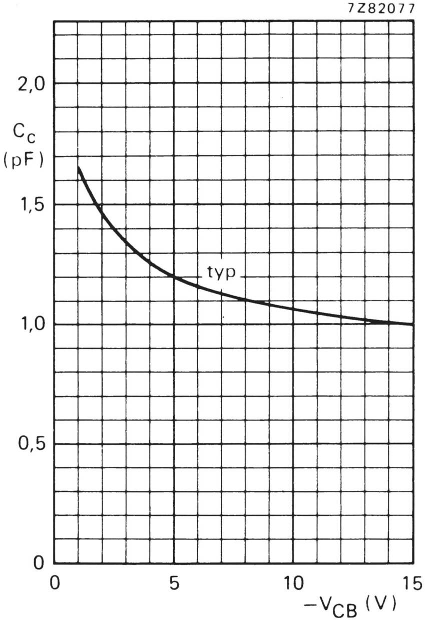


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; $T_j = 25$ °C; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a subminiature plastic transfer-moulded T-package.

It is intended for use in u.h.f. applications such as broadband aerial amplifiers (30 MHz to 860 MHz) and in microwave amplifiers such as radar systems, spectrum analysers etc.

The BFQ32 offers a high transition frequency and a low intermodulation distortion figure over a wide current range.

QUICK REFERENCE DATA

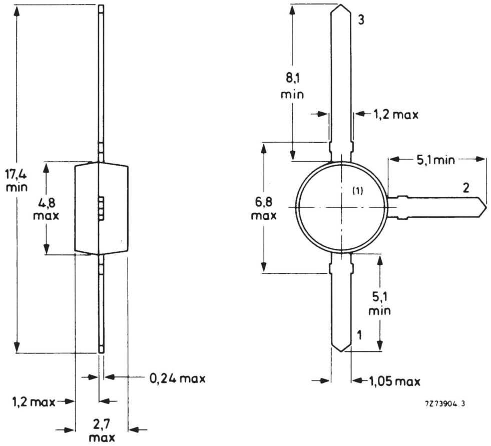
Collector-base voltage (open emitter)	$-V_{CBO}$	max	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max	15	V
Collector current (d.c.)	$-I_C$	max	75	mA
Total power dissipation up to $T_{amb} = 60\ ^oC$	P_{tot}	max	500	mW
Junction temperature	T_j	max	175	^oC
Transition frequency at f = 500 MHz $-I_C = 50$ mA; $-V_{CE} = 10$ V	f_T	>	3,6	GHz
Feedback capacitance at f = 1 MHz $-I_C = 10$ mA; $-V_{CE} = 10$ V	C_{re}	<	1,4	pF
Noise figure at optimum source impedance $-I_C = 50$ mA; $-V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	F	typ	3,75	dB
Intermodulation distortion at $T_{amb} = 25\ ^oC$ $-I_C = 50$ mA; $-V_{CE} = 10$ V; $R_L = 75\ \Omega$; $V_o = 500$ mV $f_{(p+q-r)} = 493,25$ MHz (see page 4)	d_{im}	typ	−60	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections
1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max	3	V
Collector current (d.c.)	$-I_C$	max	75	mA
Collector current (peak value); $f > 1$ MHz	$-I_{CM}$	max	150	mA
Total power dissipation up to $T_{amb} = 60$ °C mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	P_{tot}		500	mW
Storage temperature	T_{stg}	−65 to + 175		°C
Junction temperature	T_j	max	175	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0,23	°C/mW

CHARACTERISTICS

$T_{amb} = 25$ °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 10$ V	$-I_{CBO}$	<	100	nA
D.C. current gain *				
$-I_C = 50$ mA; $-V_{CE} = 10$ V	h_{FE}	>	20	
$-I_C = 75$ mA; $-V_{CE} = 10$ V	h_{FE}	>	20	
Transition frequency at f = 500 MHz *				
$-I_C = 50$ mA; $-V_{CE} = 10$ V	f_T	> typ	3,6 4,2	GHz GHz
$-I_C = 75$ mA; $-V_{CE} = 10$ V	f_T	> typ	4,0 4,6	GHz GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ	1,3	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $-V_{EB} = 0,5$ V	C_e	typ	6	pF
Feedback capacitance at f = 1 MHz $-I_C = 10$ mA; $-V_{CE} = 10$ V	C_{re}	< typ	1,4 1,25	pF pF

---

* Measured under pulse conditions.

Noise figure at optimum source impedance $-I_C = 50$ mA; $-V_{CE} = 10$ V; f = 500 MHz	F	typ	3,75 dB
Maximum unilateral power gain (s_{re} assumed to be zero) G_{UM} (in dB) $= 10 \log \frac{\lvert s_{fe} \rvert^2}{(1-\lvert s_{ie} \rvert^2)(1-\lvert s_{oe} \rvert^2)}$ $-I_C = 50$ mA; $-V_{CE} = 10$ V; f = 500 MHz	G_{UM}	typ	14 dB
Intermodulation distortion (see fig. 1) $-I_C = 50$ mA; $-V_{CE} = 10$ V; $R_L = 75\ \Omega$ $V_p = V_o = 500$ mV at $f_p = 495{,}25$ MHz $V_q = V_o - 6$ dB at $f_q = 503{,}25$ MHz $V_r = V_o - 6$ dB at $f_r = 505{,}25$ MHz Measured at $f_{(p+q-r)} = 493{,}25$ MHz	d_{im}	typ	−60 dB

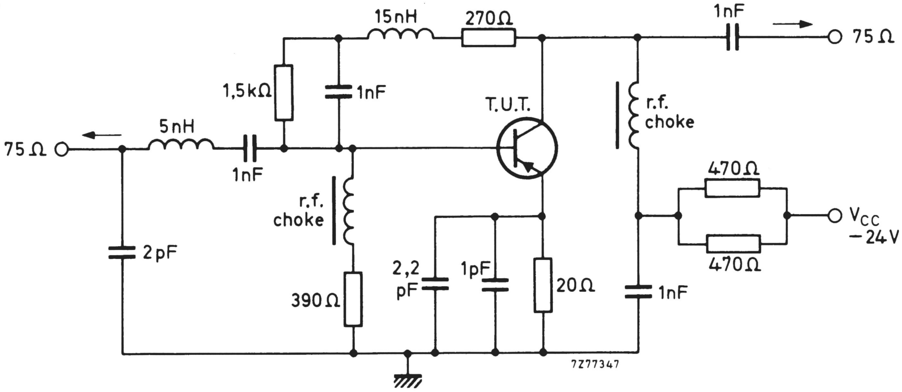
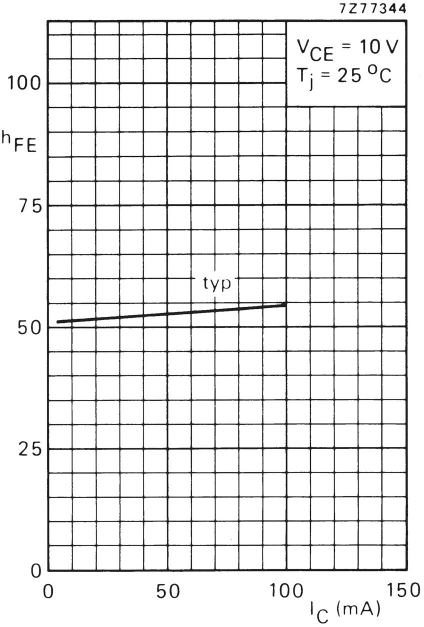
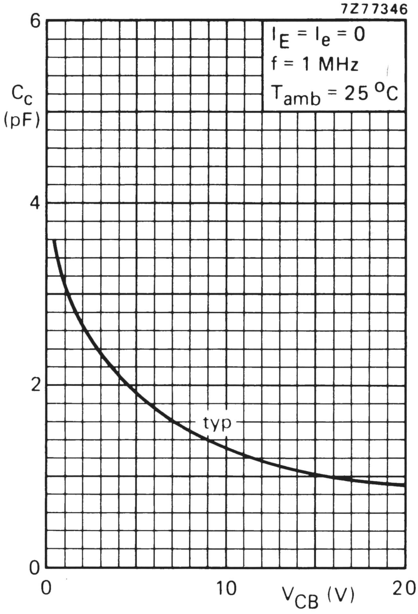
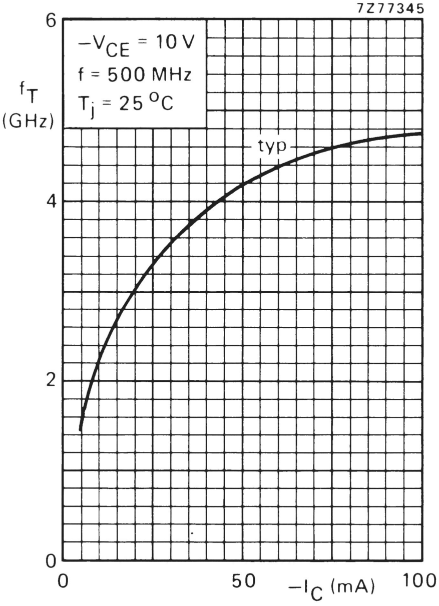

15nH
270Ω
1nF
75Ω
1,5kΩ
1nF
T.U.T.
r.f. choke
5nH
75Ω
1nF
470Ω
r.f. choke
V_CC −24V
2pF
470Ω
2,2 pF
1pF
20Ω
1nF
390Ω
7Z77347

Fig. 1 Intermodulation test circuit.


7Z77344
V_CE = 10 V
T_j = 25 °C
h_FE
100
75
50
25
0
typ
0
50
100
150
I_C (mA)


7Z77346
I_E = I_e = 0
f = 1 MHz
T_amb = 25 °C
C_c
(pF)
6
4
2
0
typ
0
10
V_CB (V)
20


7Z77345
−V_CE = 10 V
f = 500 MHz
T_j = 25 °C
f_T
(GHz)
6
4
2
0
typ
0
50
−I_C (mA)
100

N-P-N MICROWAVE TRANSISTOR

The BFQ33 is a small-signal silicon planar epitaxial transistor in a miniature hermetically sealed micro-stripline encapsulation, featuring an extremely high transition frequency and very low noise up to high frequencies.

It is primarily intended for use in microwave amplifier applications.

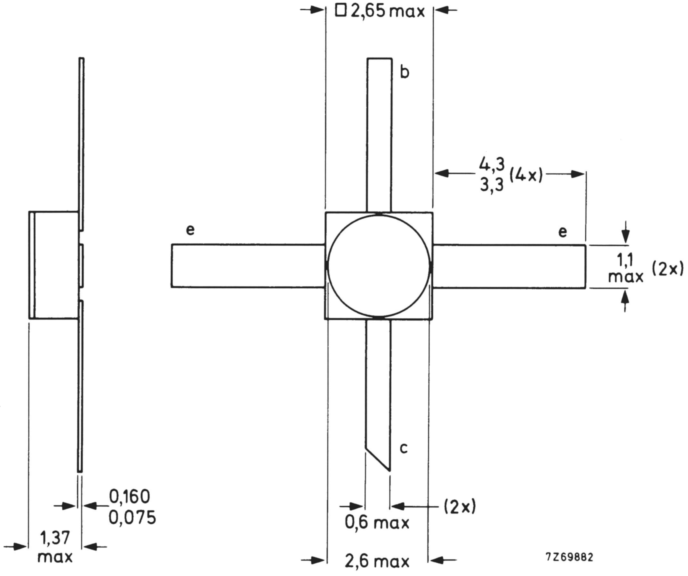
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	9	V
Collector-emitter voltage (open base)	V_{CEO}	max.	7	V
Collector current (d.c.)	I_C	max.	20	mA
Total power dissipation up to T_{amb} = 80 °C	P_{tot}	max.	140	mW
Transition frequency at f = 1,5 GHz I_C = 14 mA; V_{CE} = 5 V	f_T	typ.	12	GHz
Noise figure at optimum source impedance I_C = 5 mA; V_{CE} = 5 V; f = 2 GHz	F	typ.	2,5	dB
Maximum unilateral power gain (see page 3) I_C = 14 mA; V_{CE} = 5 V; f = 2 GHz; T_{amb} = 25 °C	G_{UM}	typ.	13,7	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-100.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	9	V
Collector-emitter voltage (open base)	V_{CEO}	max.	7	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	20	mA
Total power dissipation up to T_{amb} = 80 °C	P_{tot}	max.	140	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	500	K/W*

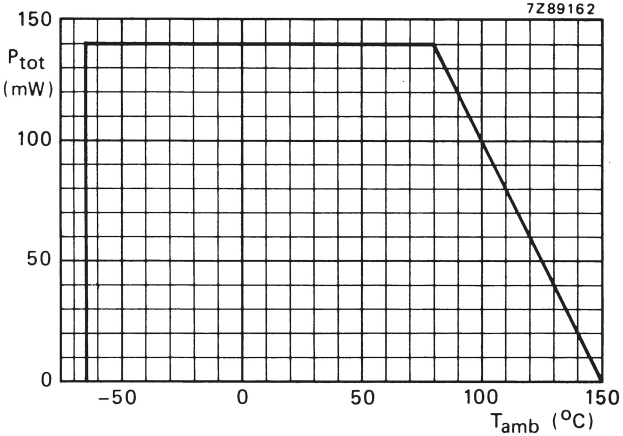


Fig. 2 Power derating curve versus ambient temperature.

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* K/W is SI unit for °C/W.

DEVELOPMENT SAMPLE DATA

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50 nA
D.C. current gain*			
$I_C = 14$ mA; $V_{CE} = 5$ V	h_{FE}	>	25
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0,45 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0$; $V_{CE} = 5$ V	C_{re}	typ.	0,2 pF
Transition frequency at f = 1,5 GHz*			
$I_C = 14$ mA; $V_{CE} = 5$ V	f_T	typ.	12 GHz
Noise figure at optimum source impedance			
$I_C = 5$ mA; $V_{CE} = 5$ V; f = 2 GHz	F	typ.	2,5 dB
$I_C = 5$ mA; $V_{CE} = 5$ V; f = 4 GHz	F	typ.	3,8 dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

$I_C = 14$ mA; $V_{CE} = 5$ V; f = 2 GHz	G_{UM}	typ.	13,7 dB
$I_C = 14$ mA; $V_{CE} = 5$ V; f = 4 GHz	G_{UM}	typ.	7,4 dB
s-parameters (common emitter)			
$I_C = 14$ mA; $V_{CE} = 5$ V; $R_S = R_L = 50\ \Omega$; f = 2 GHz			
Input reflection coefficient	s_{ie}	typ.	0,18/−155°
Reverse transmission coefficient	s_{re}	typ.	0,10/ +49°
Forward transmission coefficient	s_{fe}	typ.	4,3 / +75°
Output reflection coefficient	s_{oe}	typ.	0,43/ −56°
$I_C = 14$ mA; $V_{CE} = 5$ V; $R_S = R_L = 50\ \Omega$; f = 4 GHz			
Input reflection coefficient	s_{ie}	typ.	0,19/+171°
Reverse transmission coefficient	s_{re}	typ.	0,14/ +34°
Forward transmission coefficient	s_{fe}	typ.	2,0 / +48°
Output reflection coefficient	s_{oe}	typ.	0,50/ −89°

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* Measured under pulse conditions.

Conditions for Figs 3 and 4:
V_{CE} = 5 V; I_C = 14 mA;
T_{amb} = 25 °C.

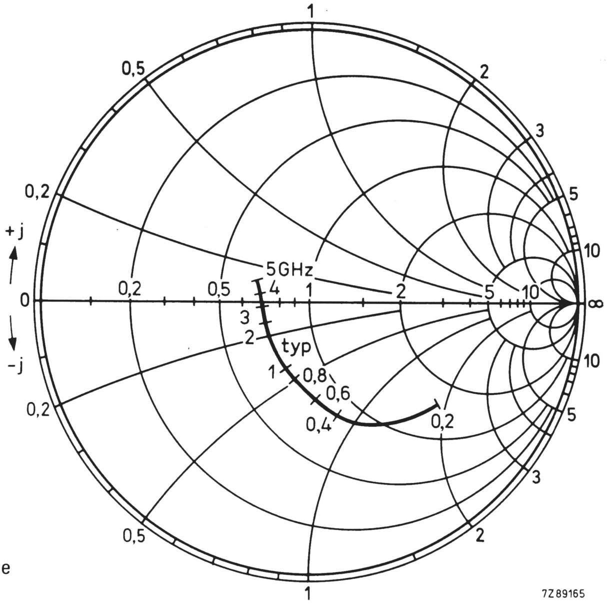


Fig. 3 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

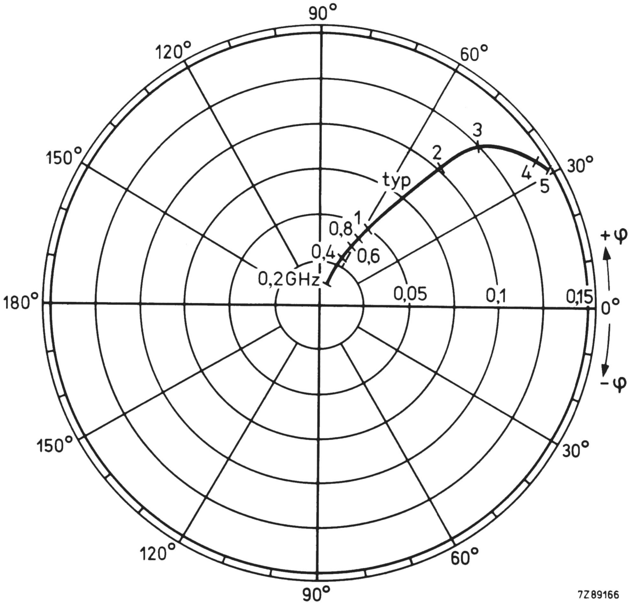


Fig. 4 Reverse transmission coefficient s_{re}.

DEVELOPMENT SAMPLE DATA

Conditions for Figs 5 and 6:
V_{CE} = 5 V; I_C = 14 mA;
T_{amb} = 25 °C.

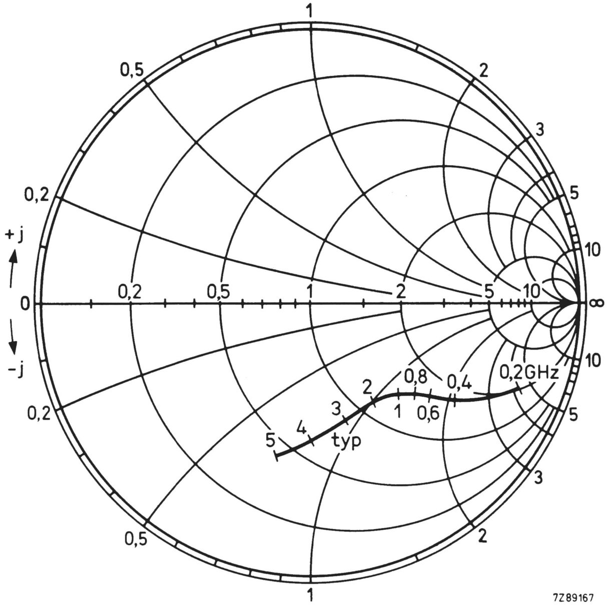


Fig. 5 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

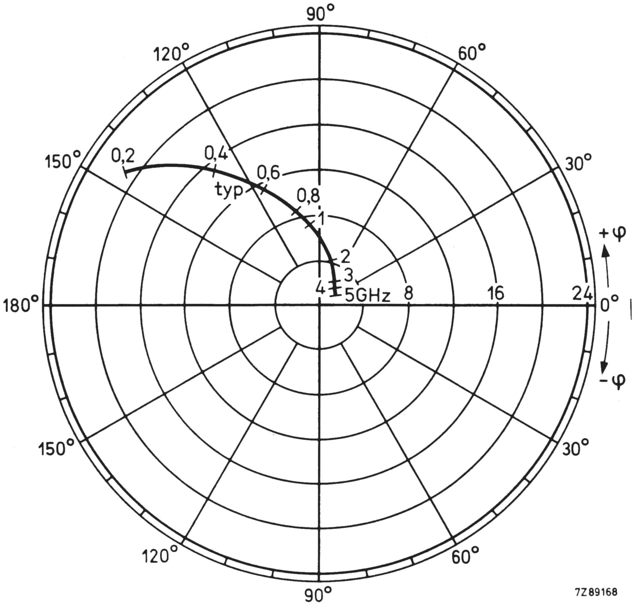


Fig. 6 Forward transmission coefficient s_{fe}.

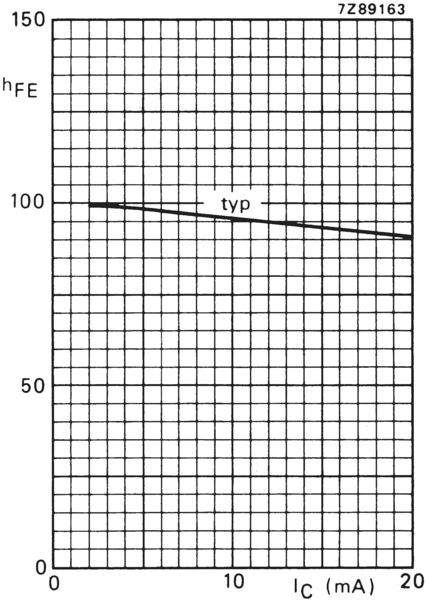


Fig. 7 V_{CE} = 5 V; T_j = 25 °C.

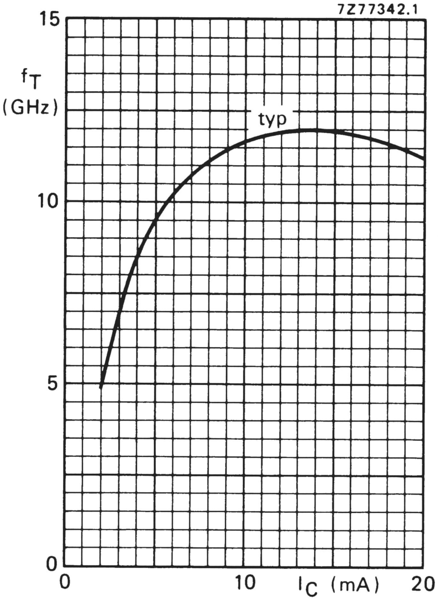


Fig. 8 V_{CE} = 5 V; f = 1,5 GHz; T_j = 25 °C.

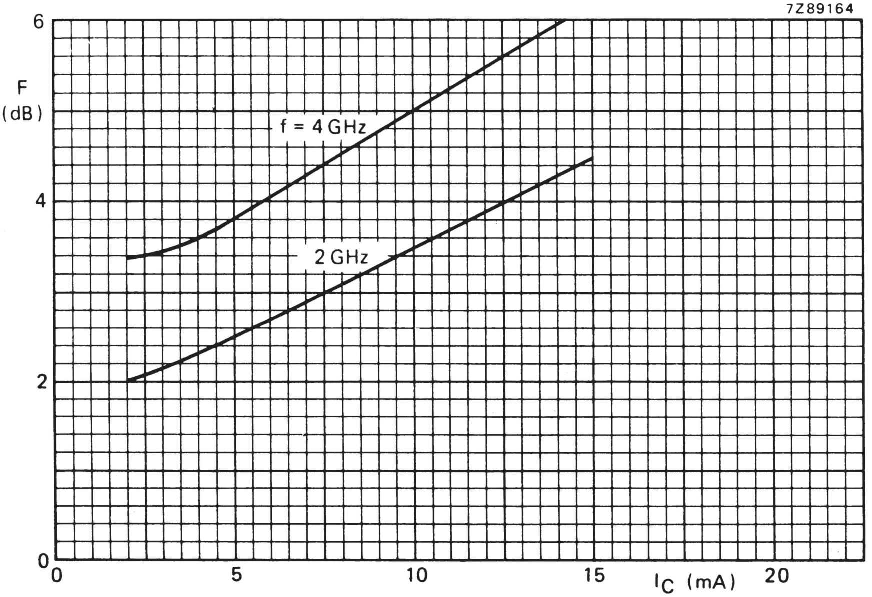


Fig. 9 V_{CE} = 5 V; Z_S = optimum; T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor primarily intended for driver and final stages in MATV system amplifiers. This device is also suitable for use in low power band IV and V equipment. Diffused emitter ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ¼″ capstan envelope with ceramic cap. All leads are isolated from the stud.

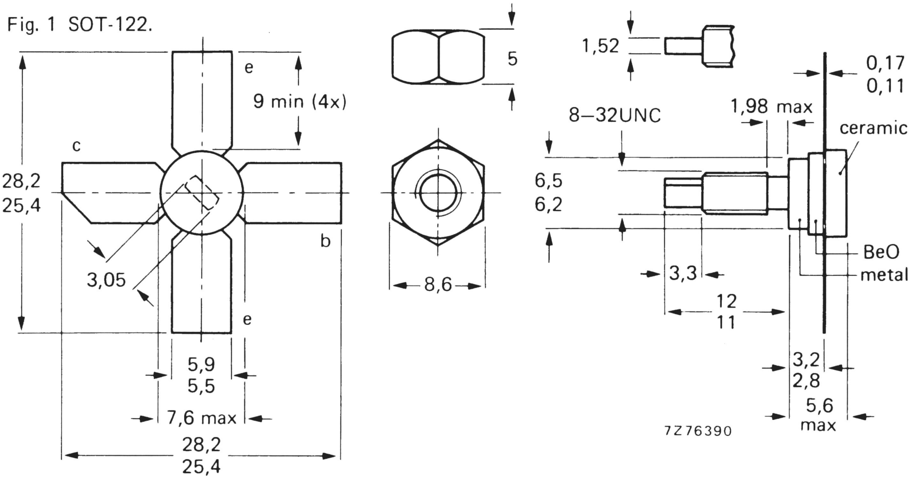
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation (d.c.) up to T_{mb} = 125 °C	P_{tot}	max.	2,25	W
Operating junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 150 mA; V_{CE} = 15 V; T_j = 25 °C	f_T	>	3,5	GHz
Output voltage at d_{im} = −60 dB (see Figs 2 and 4) I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	1,2	V

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base) (see Fig. 3)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation (d.c.) up to T_{mb} = 125 °C (see Fig. 3)	P_{tot}	max.	2,25	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	15,0	K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W*

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 15 V	I_{CBO}	<	100	µA
D.C. current gain** I_C = 75 mA; V_{CE} = 15 V	h_{FE}	>	25	
I_C = 150 mA; V_{CE} = 15 V	h_{FE}	>	25	
Transition frequency at f = 500 MHz** I_C = 75 mA; V_{CE} = 15 V	f_T	> typ.	3,0 3,5	GHz GHz
I_C = 150 mA; V_{CE} = 15 V	f_T	> typ.	3,5 4,0	GHz GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; V_{CB} = 15 V	C_c	typ. <	2,0 2,75	pF pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; V_{EB} = 0,5 V	C_e	typ.	11	pF
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 15 V	C_{re}	typ. <	1,0 1,35	pF pF
Collector-stud capacitance	C_{cs}	typ.	2	pF
Noise figure measured in MATV test circuit (see Fig. 2) I_C = 120 mA; V_{CE} = 15 V; f = 500 MHz	F	typ.	8	dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

I_C = 120 mA; V_{CE} = 15 V; f = 500 MHz	G_{UM}	typ.	16,3	dB

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* K/W is SI unit for °C/W.

** Measured under pulse conditions.

Output voltage at d_{im} = −60 dB (see Figs 2 and 4)
(DIN 45004B, par. 6.3: 3-tone)
I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω
$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz
measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 1,2 V

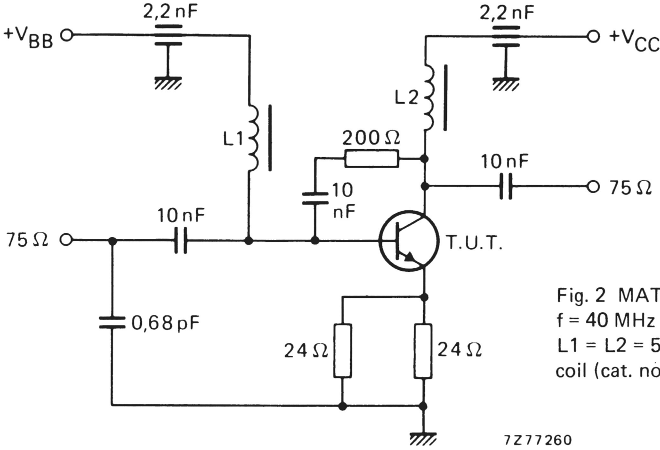

2,2 nF
+V_BB
2,2 nF
+V_CC
L2
L1
200 Ω
10 nF
75 Ω
10 nF
10 nF
75 Ω
T.U.T.
0,68 pF
24 Ω
24 Ω
7Z77260

Fig. 2 MATV test circuit
f = 40 MHz to 860 MHz.
L1 = L2 = 5 μH Ferroxcube coil (cat. no. 3122 108 20153).

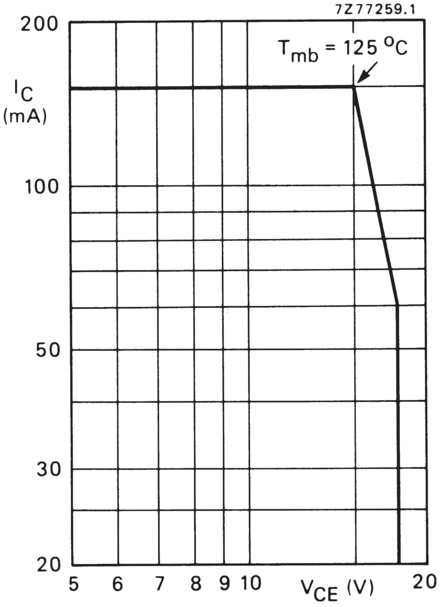


Fig. 3 D.C. SOAR.

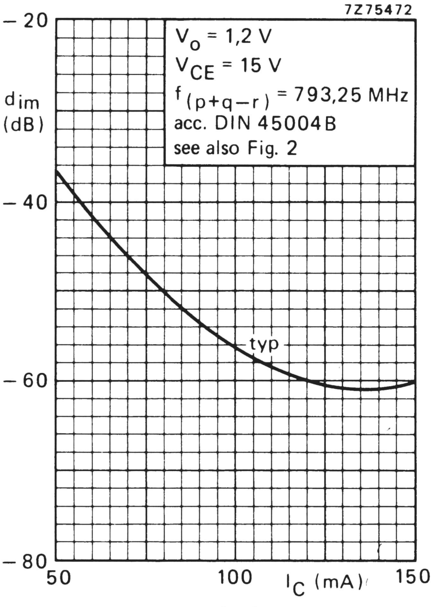


Fig. 4.

s-parameters (common emitter) at V_{CE} = 7,5 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
50	40	0,47/ −72°	0,02/64°	30,5/147°	0,85/ −34°
	200	0,55/−154°	0,06/52°	11,3/101°	0,36/ −84°
	500	0,54/+ 177°	0,08/58°	4,9/ 78°	0,25/−104°
	800	0,52/+ 160°	0,12/58°	3,2/ 63°	0,25/−113°
	1000	0,50/+ 150°	0,15/57°	2,6/ 54°	0,26/−118°
	1200	0,48/+ 142°	0,18/54°	2,2/ 46°	0,28/−122°
75	40	0,45/ −76°	0,02/64°	32,1/144°	0,83/ −36°
	200	0,54/−156°	0,05/53°	11,6/100°	0,35/ −90°
	500	0,54/+ 176°	0,08/59°	5,0/ 78°	0,24/−112°
	800	0,51/+ 160°	0,13/59°	3,3/ 63°	0,24/−121°
	1000	0,49/+ 150°	0,16/57°	2,7/ 55°	0,24/−124°
	1200	0,46/+ 142°	0,18/54°	2,3/ 47°	0,26/−128°
100	40	0,44/ −79°	0,02/63°	33,0/145°	0,82/ −37°
	200	0,54/−157°	0,06/54°	11,8/100°	0,35/ −93°
	500	0,53/+ 175°	0,09/60°	5,1/ 78°	0,23/−117°
	800	0,51/+ 159°	0,13/59°	3,3/ 64°	0,23/−126°
	1000	0,49/+ 150°	0,16/57°	2,7/ 55°	0,24/−129°
	1200	0,46/+ 142°	0,19/54°	2,3/ 47°	0,26/−131°
120	40	0,43/ −81°	0,02/63°	33,5/145°	0,82/ −38°
	200	0,54/−157°	0,05/55°	11,9/ 99°	0,35/ −95°
	500	0,53/+ 175°	0,09/60°	5,1/ 77°	0,23/−119°
	800	0,51/+ 159°	0,13/59°	3,3/ 63°	0,23/−128°
	1000	0,48/+ 149°	0,16/56°	2,7/ 55°	0,24/−131°
	1200	0,46/+ 141°	0,19/53°	2,3/ 47°	0,25/−132°
150	40	0,43/ −82°	0,02/63°	33,6/145°	0,81/ −39°
	200	0,54/−158°	0,05/55°	11,8/ 99°	0,34/ −96°
	500	0,53/+ 175°	0,09/60°	5,1/ 77°	0,23/−121°
	800	0,51/+ 159°	0,13/59°	3,3/ 63°	0,23/−129°
	1000	0,49/+ 149°	0,16/56°	2,7/ 55°	0,24/−132°
	1200	0,47/+ 141°	0,19/53°	2,3/ 47°	0,25/−134°

s-parameters (common emitter) at V_{CE} = 15 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
50	40	0,48/ −65°	0,02/62°	31,0/148°	0,83/ −30°
	200	0,53/−149°	0,04/52°	12,0/102°	0,37/ −73°
	500	0,52/+ 179°	0,08/58°	5,2/ 78°	0,25/ −89°
	800	0,50/+ 162°	0,12/59°	3,4/ 64°	0,26/ −99°
	1000	0,47/+ 152°	0,14/57°	2,8/ 55°	0,28/−104°
	1200	0,45/+ 144°	0,17/55°	2,3/ 47°	0,31/−109°
75	40	0,46/ −68°	0,02/62°	32,9/148°	0,82/ −32°
	200	0,52/−151°	0,04/53°	12,5/101°	0,36/ −79°
	500	0,51/+ 178°	0,08/59°	5,4/ 78°	0,24/ −97°
	800	0,48/+ 161°	0,12/59°	3,5/ 64°	0,24/−106°
	1000	0,46/+ 152°	0,15/57°	2,8/ 56°	0,26/−110°
	1200	0,44/+ 144°	0,17/55°	2,4/ 48°	0,28/−114°
100	40	0,47/ −69°	0,02/62°	33,9/147°	0,81/ −34°
	200	0,51/−151°	0,04/54°	12,6/101°	0,35/ −82°
	500	0,50/+ 178°	0,08/59°	5,5/ 78°	0,23/−101°
	800	0,48/+ 161°	0,12/59°	3,5/ 64°	0,23/−109°
	1000	0,45/+ 152°	0,15/57°	2,9/ 56°	0,25/−113°
	1200	0,43/+ 144°	0,18/54°	2,4/ 48°	0,27/−117°
120	40	0,47/ −69°	0,02/62°	34,6/146°	0,81/ −34°
	200	0,51/−151°	0,04/54°	12,7/101°	0,35/ −83°
	500	0,50/+ 178°	0,08/60°	5,5/ 78°	0,23/−103°
	800	0,48/+ 161°	0,12/59°	3,5/ 64°	0,23/−112°
	1000	0,45/+ 152°	0,15/57°	2,9/ 56°	0,24/−115°
	1200	0,43/+ 144°	0,18/54°	2,4/ 48°	0,26/−118°
150	40	0,49/ −70°	0,02/61°	34,8/146°	0,80/ −35°
	200	0,52/−152°	0,04/54°	12,6/100°	0,34/ −84°
	500	0,50/+ 178°	0,08/60°	5,4/ 78°	0,23/−103°
	800	0,48/+ 162°	0,12/59°	3,5/ 64°	0,23/−111°
	1000	0,46/+ 152°	0,15/57°	2,8/ 55°	0,24/−114°
	1200	0,44/+ 144°	0,18/54°	2,4/ 48°	0,27/−117°

Conditions for Figs 5 and 6:
V_{CE} = 15 V; I_C = 120 mA;
T_{amb} = 25 °C.

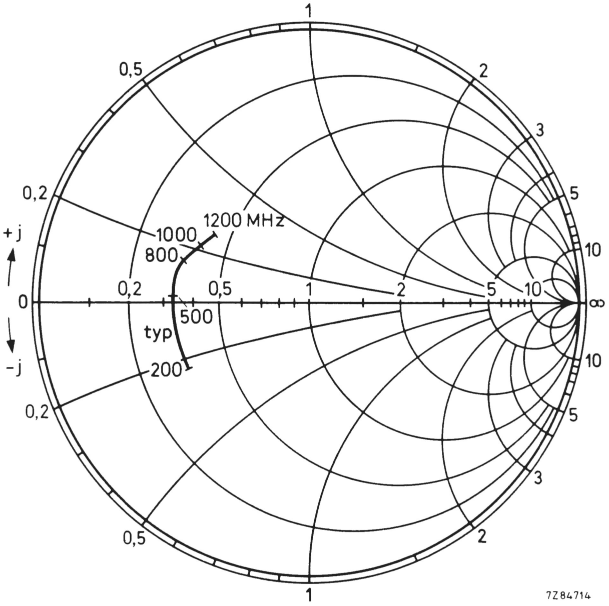


Fig. 5 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

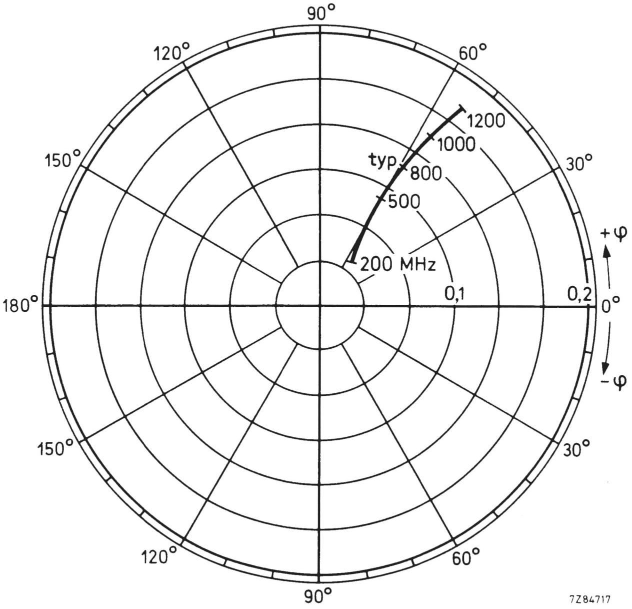


Fig. 6 Reverse transmission coefficient s_{re}.

Conditions for Figs 7 and 8:
$V_{CE} = 15$ V; $I_C = 120$ mA;
$T_{amb} = 25$ °C.

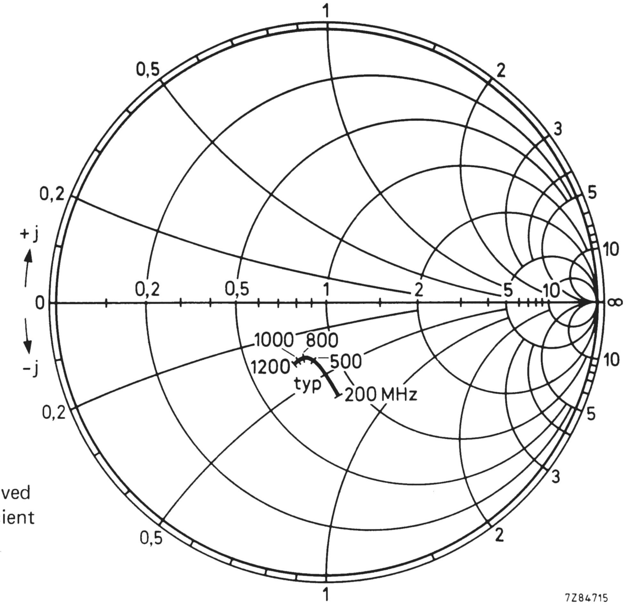


Fig. 7 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

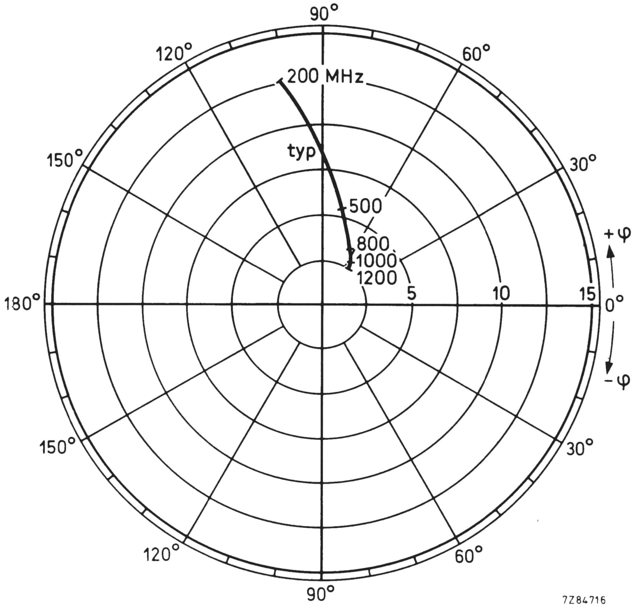


Fig. 8 Forward transmission coefficient s_{fe}.

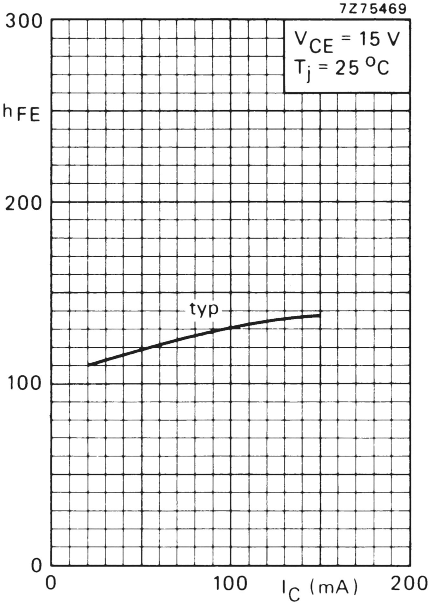


Fig. 9.

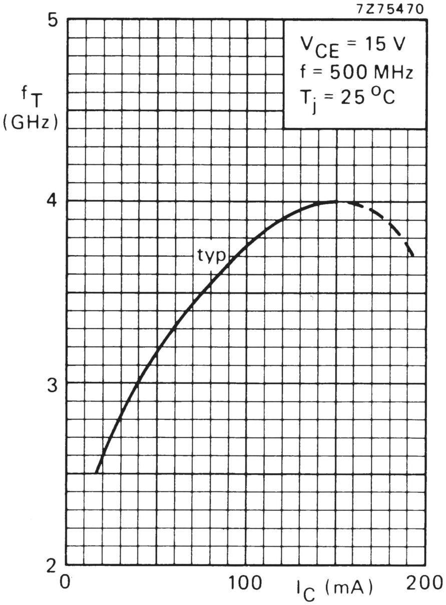


Fig. 10.

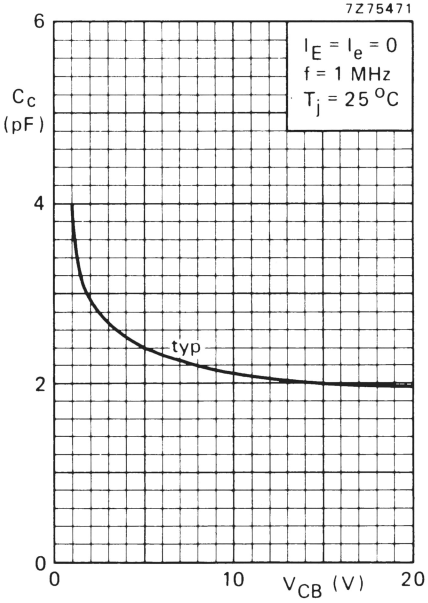


Fig. 11.

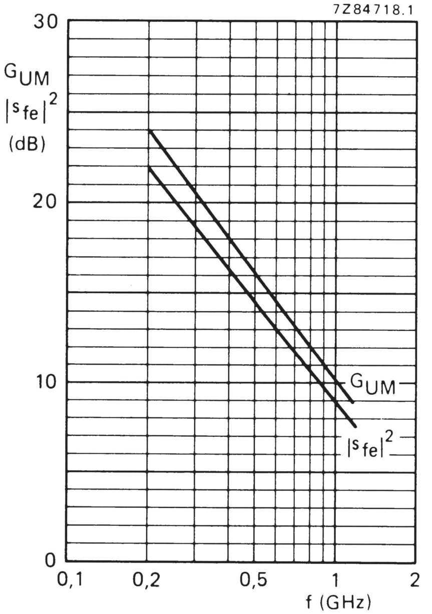


Fig. 12 V_{CE} = 15 V; I_C = 120 mA; T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in plastic T-package, intended for wideband amplification applications. The device features high output voltage capabilities.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_{amb} = 45 °C	P_{tot}	max.	1	W
Junction temperature	T_j	max.	175	°C
D.C. current gain I_C = 100 mA; V_{CE} = 10 V	h_{FE}	min.	25	
Transition frequency at f = 500 MHz I_C = 100 mA; V_{CE} = 10 V	f_T	typ.	3,7	GHz
Maximum power gain at f = 300 MHz; T_{amb} = 25 °C I_C = 100 mA; V_{CE} = 10 V	G_M	typ.	20	dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω $f_{(p+q-r)}$ = 285,25 MHz; T_{amb} = 25 °C	V_O	typ.	1	V

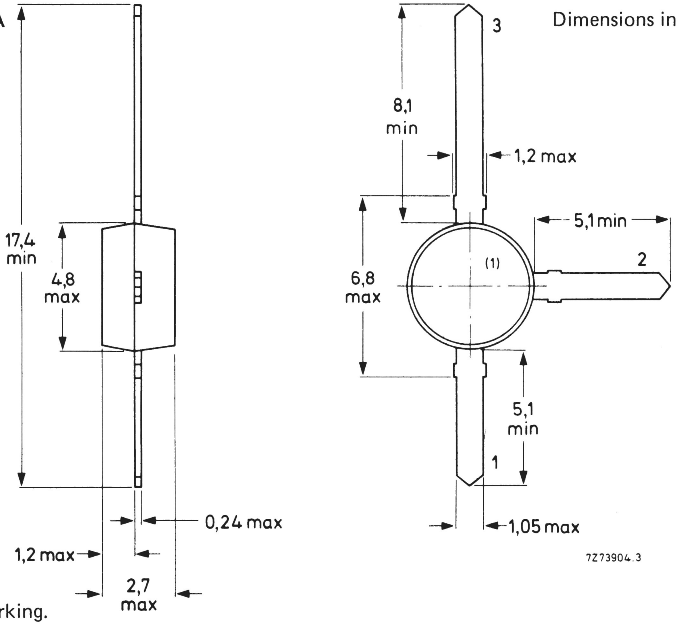
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_{amb} = 45 °C (see Fig. 2)	P_{tot}	max.	1	W
Storage temperature	T_{stg}	−65 to	+175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to case	$R_{th\ j\text{-}c}$	50	K/W*
From junction to ambient in free air mounted on a fibre-glass print (see Fig. 2)	$R_{th\ j\text{-}a}$	130	K/W*

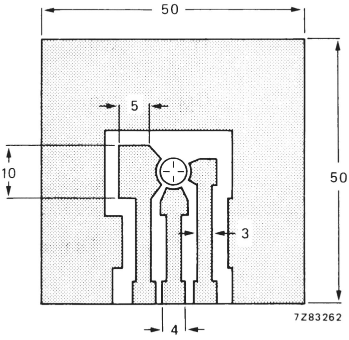


Fig. 2 Requirements for fibre-glass print. (Dimensions in mm.)
Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	max.	100	μA
D.C. current gain** $I_C = 100$ mA; $V_{CE} = 10$ V	h_{FE}	min.	25	
Transition frequency at f = 500 MHz** $I_C = 100$ mA; $V_{CE} = 10$ V	f_T	typ.	3,7	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	2,0	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	10	pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 10$ V	C_{re}	typ.	1,2	pF

* K/W is SI unit for °C/W.

** Measured under pulse conditions.

DEVELOPMENT SAMPLE DATA

CHARACTERISTICS (continued)

Maximum power gain at f = 300 MHz
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C — G_M typ. 20 dB

Output voltage at d_{im} = −60 dB (see Fig. 3)
(DIN 45004B); T_{amb} = 25 °C; I_C = 100 mA; V_{CE} = 10 V;
R_L = 75 Ω

$V_p = V_o$ at d_{im} = −60 dB; f_p = 287,25 MHz
$V_q = V_o$ −6 dB; f_q = 294,25 MHz
$V_r = V_o$ −6 dB; f_r = 295,25 MHz

Measured at $f_{(p+q-r)}$ = 285,25 MHz — V_o typ. 1 V

Output voltage at d_{im} = −60 dB (see Fig. 3)
(DIN 45004B); T_{amb} = 25 °C; I_C = 90 mA;
V_{CE} = 10 V; R_L = 75 Ω

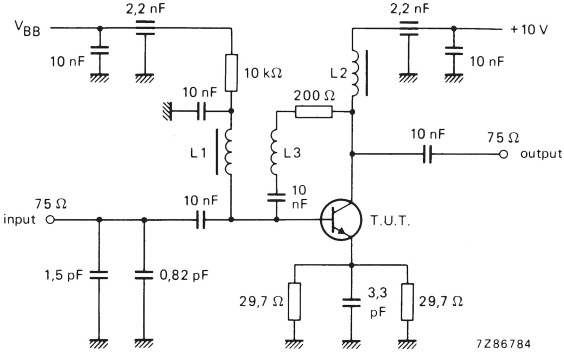
$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB; f_q = 803,25 MHz
$V_r = V_o$ −6 dB; f_r = 805,25 MHz

Measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 750 mV

Second harmonic distortion (see Fig. 3)
I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω;
T_{amb} = 25 °C

$V_p = V_o$ = 316 mV = 50 dBmV; f_p = 66 MHz
$V_q = V_o$ = 316 mV = 50 dBmV; f_q = 144 MHz

Measured at $f_{(p+q)}$ = 210 MHz — d_2 typ. −55 dB


2,2 nF
2,2 nF
V_{BB}
+10 V
10 nF
10 nF
10 kΩ
L2
10 nF
200 Ω
10 nF
75 Ω
output
L1
L3
10 nF
75 Ω
input
10 nF
T.U.T.
1,5 pF
0,82 pF
29,7 Ω
3,3 pF
29,7 Ω
7Z86784

BFQ34T

Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L2 = 5 μH Ferroxcube choke.
L3 = 2 turns Cu wire (0,5 mm); internal diameter 4 mm; winding pitch 2 mm.

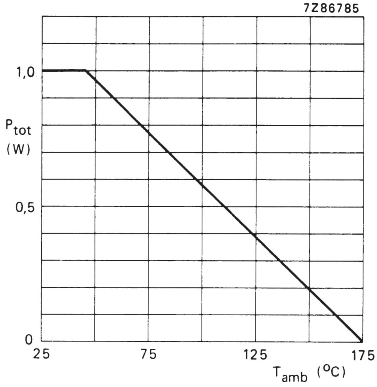


Fig. 4.

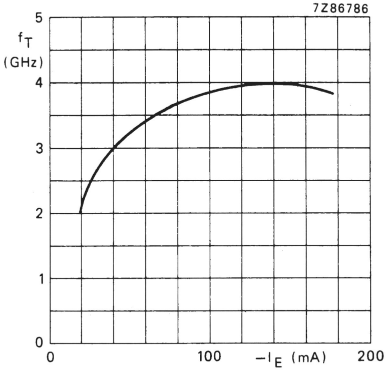


Fig. 5 V_{CE} = 10 V; f = 500 MHz.

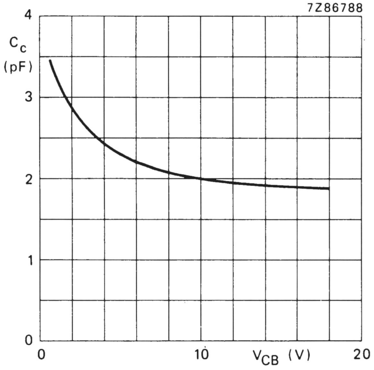


Fig. 6 I_E = 0; f = 1 MHz.

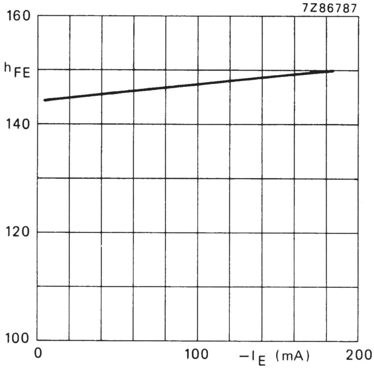


Fig. 7 V_{CE} = 10 V.

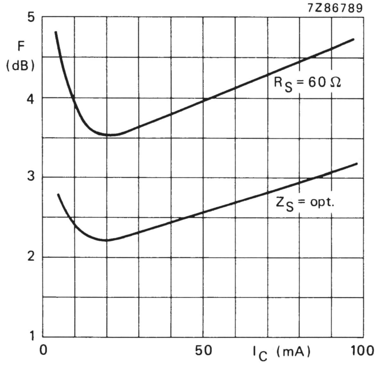


Fig. 8 V_{CE} = 10 V; f = 800 MHz.

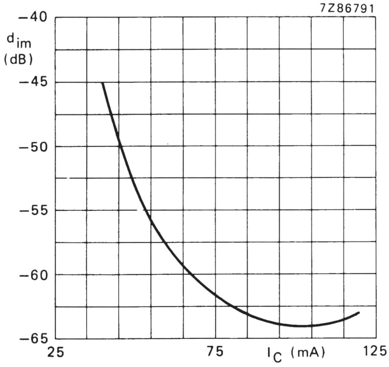


Fig. 9 V_{CE} = 10 V; V_o = 58 dBmV;
$f_{(p+q-r)}$ = 285,25 MHz.

DEVELOPMENT SAMPLE DATA

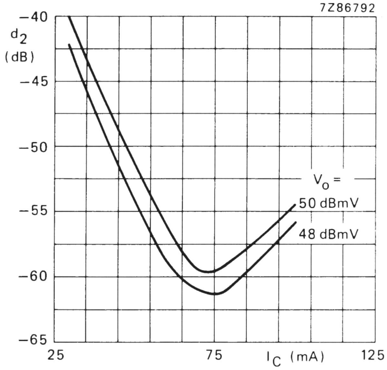


Fig. 10 $V_{CE} = 10$ V; $f_p = 66$ MHz; $f_q = 144$ MHz; $f_{(p+q)} = 210$ MHz.

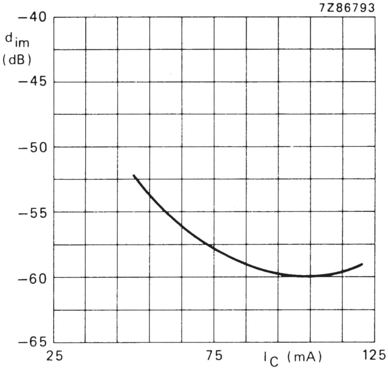


Fig. 11 $V_{CE} = 10$ V; $V_o = 750$ mV; $f_{(p+q-r)} = 793{,}24$ MHz.

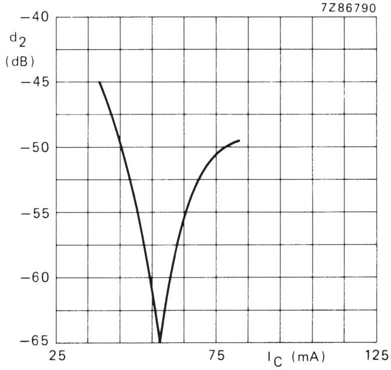


Fig. 12 $V_{CE} = 10$ V; $V_o = 48$ dBmV; $f_p = 560$ MHz; $f_q = 250$ MHz; $f_{(p+q)} = 810$ MHz.

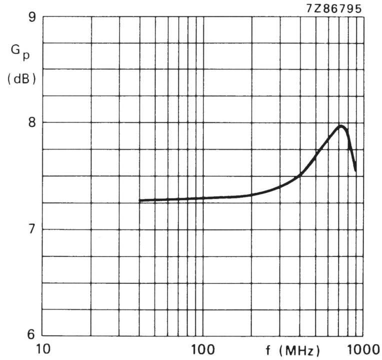


Fig. 13 Gain measured in test circuit (Fig. 3).

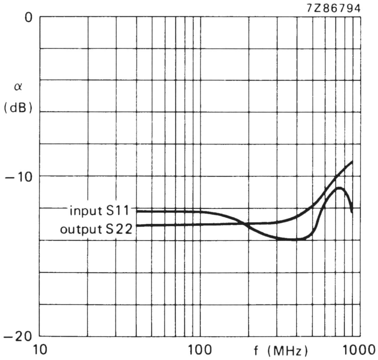


Fig. 14 Return losses measured in test circuit (Fig. 3).

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a subminiature plastic transfer-moulded T-package. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

N-P-N complements are BFR90 and BFR90A.

QUICK REFERENCE DATA

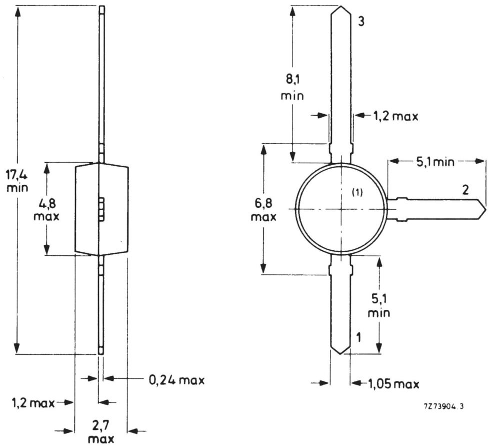
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15 V
Collector current (d.c.)	$-I_C$	max.	25 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180 mW
Junction temperature	T_j	max.	150 °C
Transition frequency at f = 500 MHz $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	f_T	typ.	5 GHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,45 pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,7 dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections
1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Collector current (peak value) at $f > 1$ MHz	$-I_{CM}$	max.	35	mA
Total power dissipation up to $T_{amb} = 60$ °C	P_{tot}	max.	180	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\,j\text{-}a}$	=	0,5	K/mW

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Collector cut-off current $I_E = 0; -V_{CB} = 10$ V	$-I_{CBO}$	<	50	nA
D.C. current gain* $-I_C = 14$ mA; $-V_{CE} = 10$ V	h_{FE}	>	20	
Transition frequency at f = 500 MHz* $-I_C = 14$ mA; $-V_{CE} = 10$ V	f_T	typ.	5	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0; -V_{CB} = 10$ V	C_c	typ.	0,65	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0; -V_{EB} = 0,5$ V	C_e	typ.	1,2	pF
Feedback capacitance at f = 1 MHz $I_C = 0; -V_{CE} = 10$ V; $T_{amb} = 25$ °C	C_{re}	typ.	0,45	pF
Noise figure at optimum source impedance $-I_C = 2$ mA; $-V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	2,7	dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	19,0	dB

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* Measured under pulse conditions.

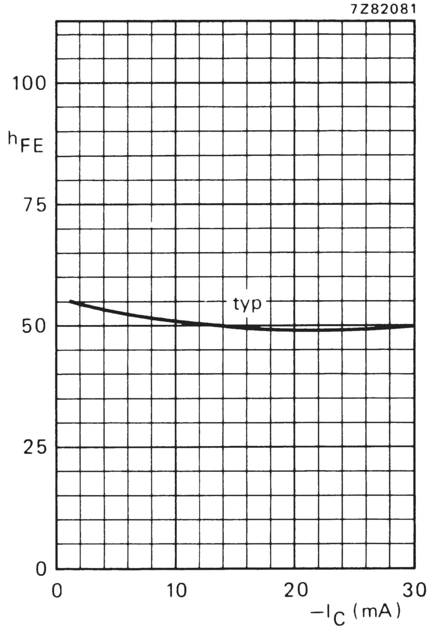


Fig. 2 $-V_{CE}$ = 10 V; T_j = 25 °C.

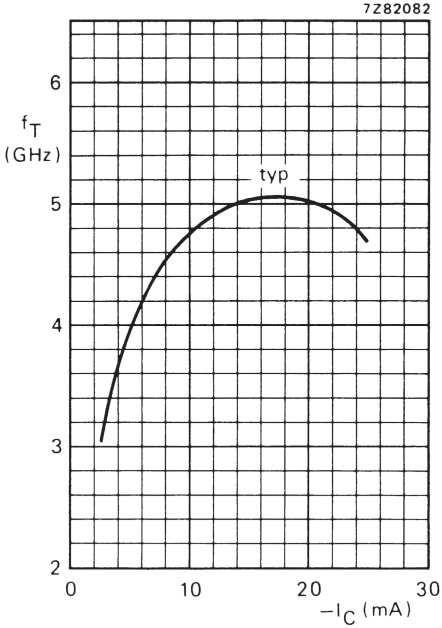


Fig. 3 $-V_{CE}$ = 10 V; f = 500 MHz; T_j = 25 °C.

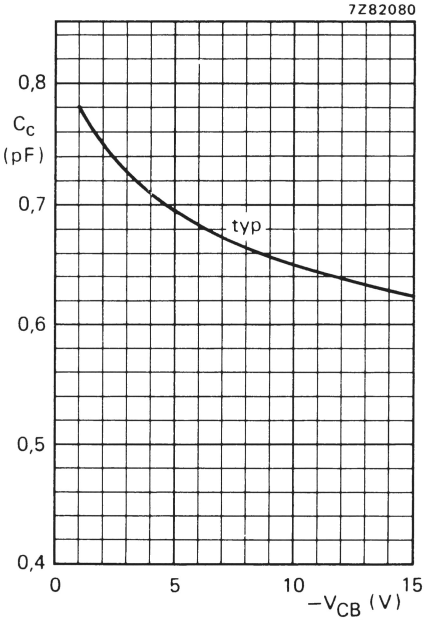


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

N-P-N complement is BFQ53.

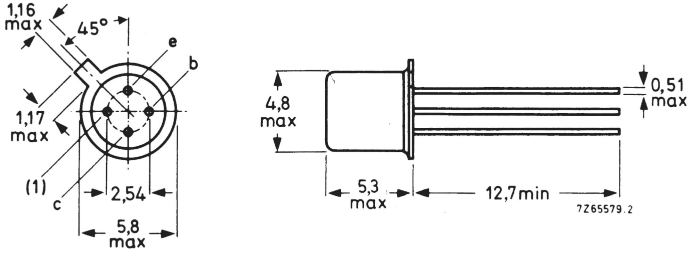
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz $-I_C$ = 14 mA; $-V_{CE}$ = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,5	pF
Noise figure at optimum source impedance $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,7	dB
Maximum unilateral power gain (see page 2) $-I_C$ = 14 mA; $-V_{CE}$ = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	17,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	15	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	2	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Collector current (peak value) at $f > 1$ MHz	$-I_{CM}$	max.	35	mA
Total power dissipation up to $T_{amb} = 65\ ^{o}C$	P_{tot}	max.	150	mW
Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,9	K/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,6	K/mW

CHARACTERISTICS

$T_j = 25\ ^{o}C$ unless otherwise specified

Collector cut-off current $I_E = 0; -V_{CB} = 10$ V	$-I_{CBO}$	<	50	nA
D.C. current gain (note 1) $-I_C = 14$ mA; $-V_{CE} = 10$ V	h_{FE}	> typ.	20 50	
Transition frequency (notes 1 and 2) $-I_C = 14$ mA; $-V_{CE} = 10$ V; f = 500 MHz	f_T	typ.	5	GHz
Collector capacitance (note 3) $I_E = I_e = 0; -V_{CB} = 10$ V; f = 1 MHz	C_c	typ.	0,85	pF
Emitter capacitance $I_C = I_c = 0; -V_{EB} = 0{,}5$ V; f = 1 MHz	C_e	typ.	1,2	pF
Feedback capacitance (note 2) $I_C = 0; -V_{CE} = 10$ V; f = 1 MHz; $T_{amb} = 25\ ^{o}C$	C_{re}	typ.	0,5	pF
Noise figure at optimum source impedance (note 2) $-I_C = 2$ mA; $-V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^{o}C$	F	typ.	2,7	dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

$-I_C = 14$ mA; $-V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^{o}C$	G_{UM}	typ.	17,0	dB

Notes
1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

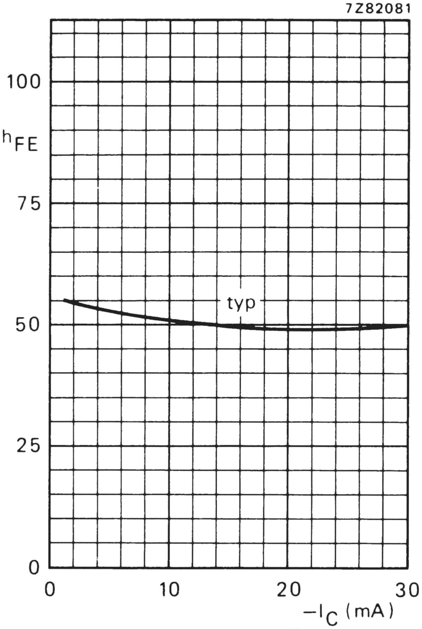


Fig. 2 $-V_{CE}$ = 10 V; T_j = 25 °C.

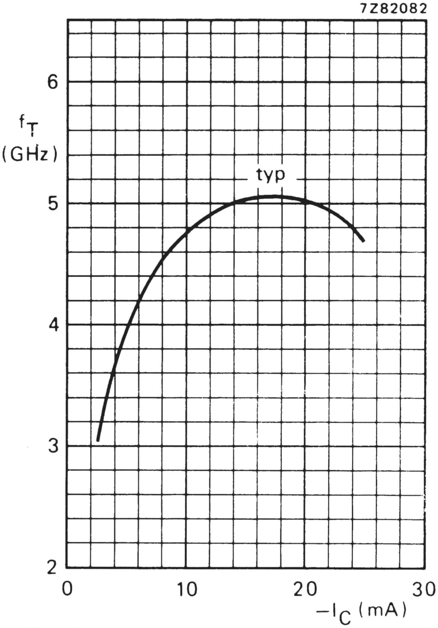


Fig. 3 $-V_{CE}$ = 10 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

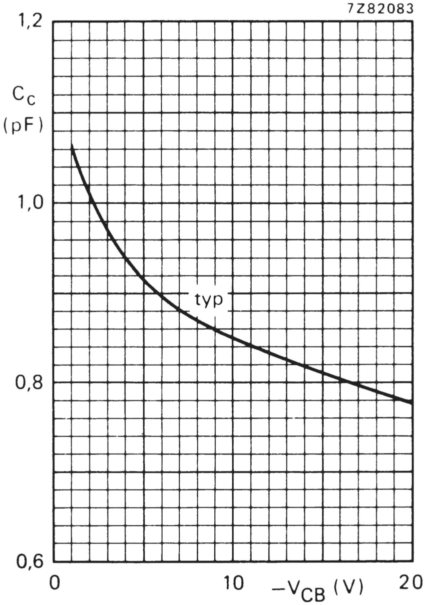


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features extremely high power gain coupled with good low noise performance.

P-N-P complement is BFQ52.

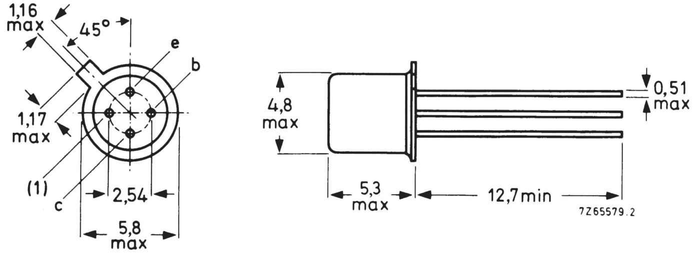
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to $T_{amb} = 65\ ^oC$	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	200	^oC
Transition frequency at f = 500 MHz $I_C = 14$ mA; $V_{CE} = 10$ V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 10$ V; $T_{amb} = 25\ ^oC$	C_{re}	typ.	0,45	pF
Noise figure at optimum source impedance $I_C = 2$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	F	typ.	2,4	dB
Maximum unilateral power gain (see page 2) $I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	18,0	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2 V
Collector current (d.c.)	I_C	max.	25 mA
Collector current (peak value) at f > 1 MHz	I_{CM}	max.	35 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	150 mW
Storage temperature	T_{stg}		−65 to +200 °C
Junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,9 K/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,6 K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50 nA
D.C. current gain (note 1) $I_C = 14$ mA; $V_{CE} = 10$ V	h_{FE}	> typ.	25 50
Transition frequency (notes 1 and 2) $I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz	f_T	typ.	5 GHz
Collector capacitance (note 3) $I_E = I_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	C_c	typ.	0,75 pF
Emitter capacitance $I_C = I_c = 0$; $V_{EB} = 0,5$ V; f = 1 MHz	C_e	typ.	1,2 pF
Feedback capacitance (note 2) $I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz; T_{amb} = 25 °C	C_{re}	typ.	0,45 pF
Noise figure at optimum source impedance (note 2) $I_C = 2$ mA; $V_{CE} = 10$ V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4 dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM}\ (\text{in dB}) = \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	18,0 dB

Notes

1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead not connected.

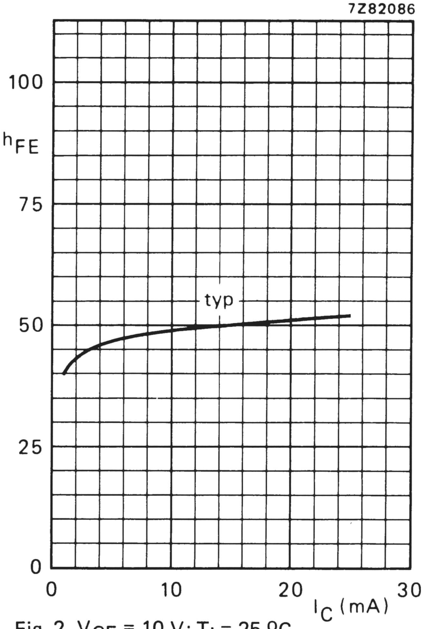


Fig. 2 V_{CE} = 10 V; T_j = 25 °C.

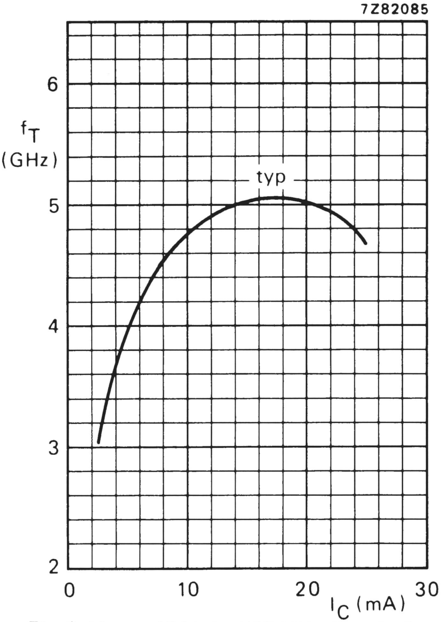


Fig. 3 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

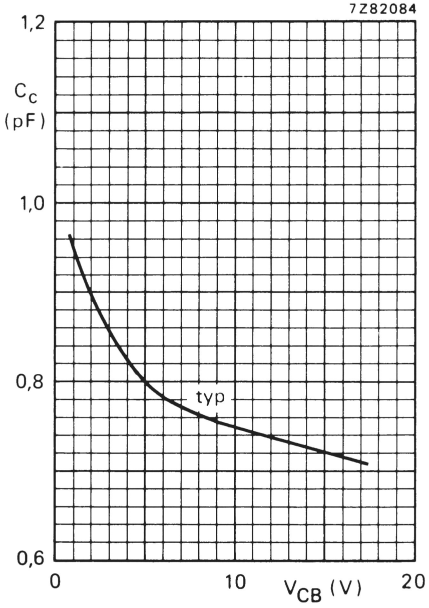


Fig. 4 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C; shield lead not connected.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.

The transistor features the combination of high power gain, high transition frequency and low noise up to high frequencies.

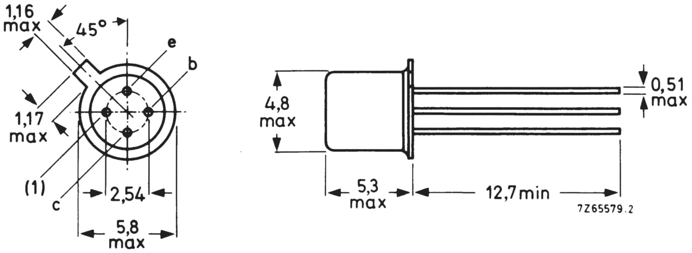
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	75	mA
Total power dissipation up to T_{amb} = 50 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 5 V	f_T	typ.	4,5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	1,0	pF
Noise figure at optimum source impedance I_C = 10 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	F	$<$	3,0	dB
Maximum unilateral power gain (see page 2) I_C = 20 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	$>$	17,5	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72 with insulated electrodes.



(1) shield lead connected to case.

Accessories: 56246 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V
Collector current (d.c.)	I_C	max.	75	mA
Collector current (peak value) at $f > 1$ MHz	I_{CM}	max.	150	mA
Total power dissipation up to $T_{amb} = 50\ ^oC$	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to +200		^oC
Junction temperature	T_j	max.	200	^oC

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	600	K/W
From junction to case	$R_{th\ j\text{-}c}$	=	350	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	100	nA
D.C. current gain (note 1) $I_C = 20$ mA; $V_{CE} = 5$ V	h_{FE}	> <	50 150	
Transistion frequency (notes 1 and 2) $I_C = 50$ mA; $V_{CE} = 5$ V; $f = 500$ MHz	f_T	typ.	4,5	GHz
Collector capacitance (note 3) $I_C = 0$; $V_{CB} = 5$ V; $f = 1$ MHz	C_{cb}	typ.	1,3	pF
Feedback capacitance (note 2) $I_C = 0$; $V_{CE} = 10$ V; $f = 1$ MHz; $T_{amb} = 25\ ^oC$	C_{re}	typ. <	1,0 1,4	pF pF
Noise figure at optimum source impedance (note 2) $I_C = 10$ mA; $V_{CE} = 5$ V; $f = 200$ MHz; $T_{amb} = 25\ ^oC$	F	<	3,0	dB
$I_C = 10$ mA; $V_{CE} = 5$ V; $f = 500$ MHz; $T_{amb} = 25\ ^oC$	F	typ.	2,3	dB

Maximum unilateral power gain (note 2)

s_{re} assumed to be zero

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 20$ mA; $V_{CE} = 5$ V; $f = 200$ MHz; $T_{amb} = 25\ ^oC$	G_{UM}	>	17,5	dB
$I_C = 50$ mA; $V_{CE} = 5$ V; $f = 500$ MHz; $T_{amb} = 25\ ^oC$	G_{UM}	typ.	11,5	dB

Notes
1. Measured under pulse conditions.
2. Shield lead grounded.
3. Shield lead and emitter lead connected to bridge earth.

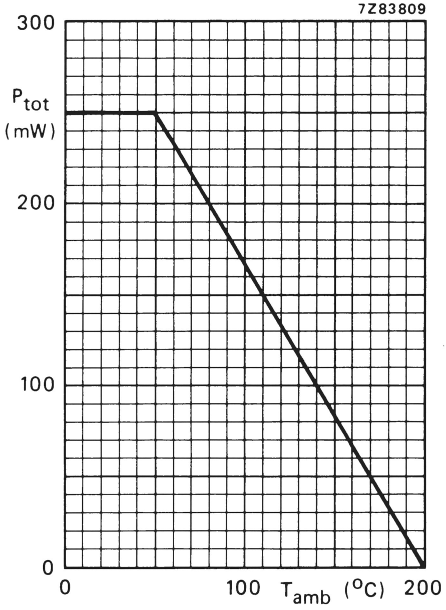


Fig. 2 Maximum permissible power dissipation in free air as a function of ambient temperature.

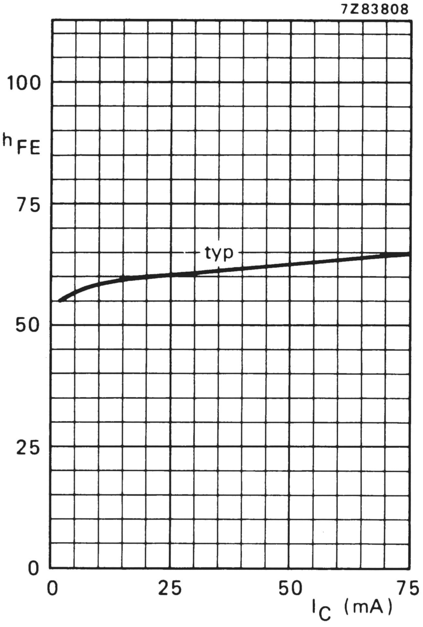


Fig. 3 V_{CE} = 5 V; T_j = 25 °C.

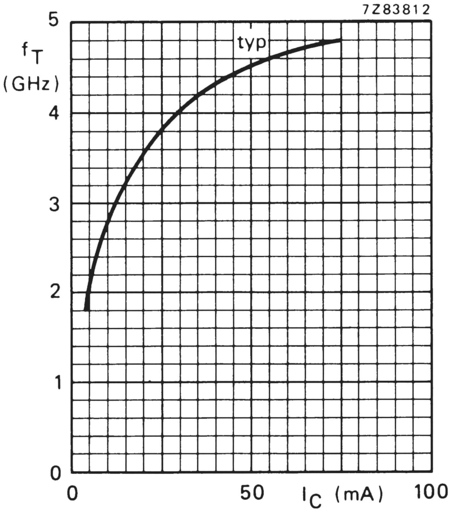


Fig. 4 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C; shield lead grounded.

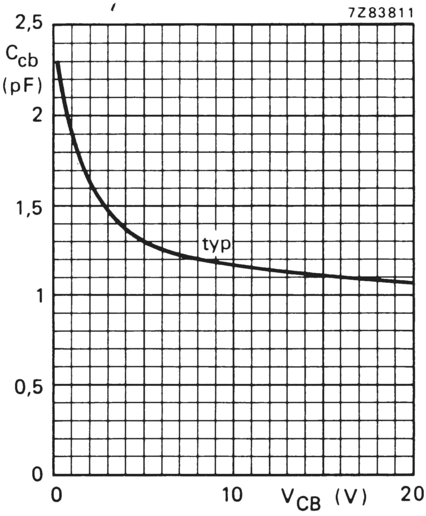


Fig. 5 I_C = 0; f = 1 MHz; T_j = 25 °C; shield lead and emitter lead connected to bridge earth.

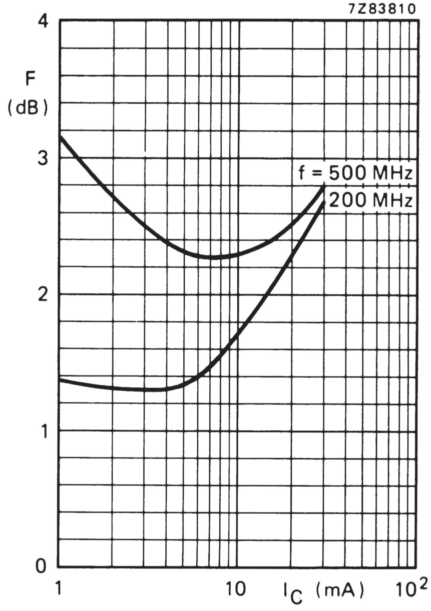


Fig. 6 V_{CE} = 5 V; Z_S = optimum; T_{amb} = 25 °C; typical values.

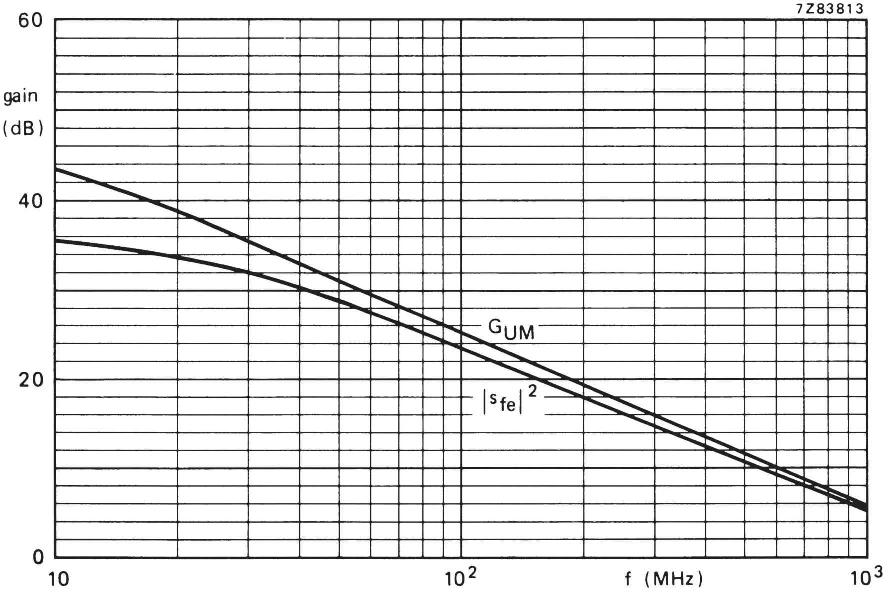


Fig. 7 V_{CE} = 5 V; I_C = 50 mA; T_{amb} = 25 °C; typical values.

DEVELOPMENT SAMPLE DATA

This information is derived from development samples
made available for evaluation. It does not necessarily
imply that the device will go into regular production.

N-P-N MICROWAVE TRANSISTOR

Small-signal planar epitaxial n-p-n transistor in plastic SOT-37 envelope and featuring a very high transition frequency and a very low noise figure up to high frequencies.

This device is designed for use in the GHz range.

QUICK REFERENCE DATA

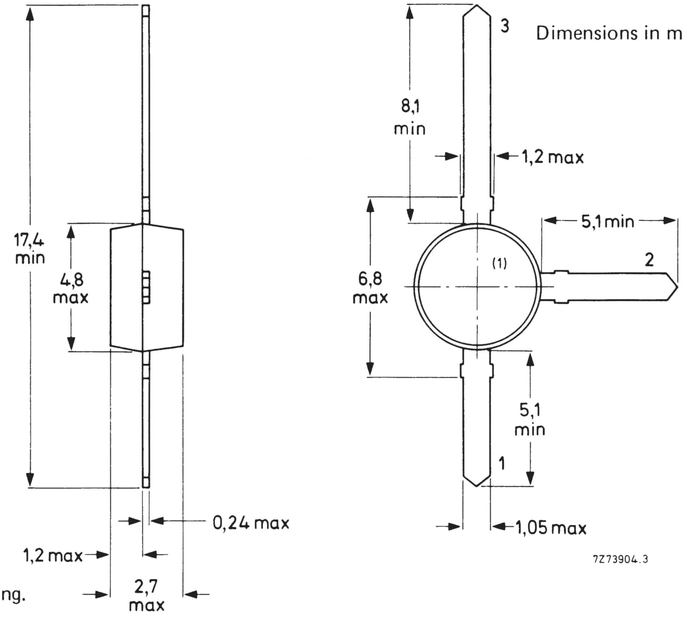
Collector-base voltage	V_{CBO}	max.	20 V
Collector-emitter voltage	V_{CEO}	max.	10 V
Collector current (d.c.)	I_C	max.	50 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
D.C. current gain I_C = 15 mA; V_{CE} = 5 V	h_{FE}	min. typ.	60 100
Transition frequency at f = 500 MHz I_C = 15 mA; V_{CE} = 8 V	f_T	typ.	7,5 GHz
Maximum unilateral power gain at f = 2 GHz I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C	G_{UM}	typ.	8,0 dB

MECHANICAL DATA

Fig. 1 SOT-37.

Connections:

1. Base
2. Emitter
3. Collector



Dimensions in mm

(1) Type number marking.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	10 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5 V
Collector current (d.c.)	I_C	max.	50 mA
Total power dissipation up to T_{amb} = 60 °C mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	P_{tot}	max.	300 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$		300 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	50 nA
D.C. current gain $I_C = 15$ mA; $V_{CE} = 5$ V	h_{FE}	min. typ.	60 100
Transition frequency at f = 500 MHz $I_C = 15$ mA; $V_{CE} = 8$ V	f_T	typ.	7,5 GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 8$ V	C_c	typ.	0,8 pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; $V_{EB} = 0{,}5$ V	C_e	typ.	1,3 pF
Feedback capacitance $I_C = 0$; $V_{CE} = 8$ V	C_{re}	typ.	0,5 pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{[1 - |s_{ie}|^2][1 - |s_{oe}|^2]}$$

$I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	G_{UM}	typ.	8,0 dB

Noise figure at f = 2 GHz; $R_S = 60\ \Omega$; $T_{amb} = 25$ °C

$I_C = 5$ mA; $V_{CE} = 8$ V	F	typ.	2,5 dB
$I_C = 15$ mA; $V_{CE} = 8$ V	F	typ.	3,0 dB

N-P-N MICROWAVE TRANSISTOR

Small-signal planar epitaxial n-p-n transistor in HERMETICALLY SEALED microstripline envelope and designed for application in the GHz range.

Features:

- hermetically sealed envelope
- gold-metallized
- very high transition frequency and very low noise in the high frequency range

QUICK REFERENCE DATA

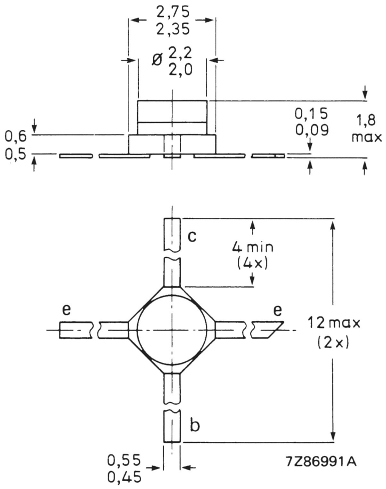
Collector-base voltage	V_{CBO}	max.	20	V
Collector-emitter voltage	V_{CEO}	max.	10	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 105 °C	P_{tot}	max.	350	mW
Junction temperature	T_j	max.	175	°C
D.C. current gain I_C = 15 mA; V_{CE} = 5 V	h_{FE}	min. typ.	60 100	
Transition frequency at f = 500 MHz I_C = 15 mA; V_{CE} = 8 V	f_T	typ.	7,5	GHz
Maximum unilateral power gain at f = 2 GHz I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C	G_{UM}	typ.	12,5	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 NO-243.

Marking code: Q6



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 105 °C mounted on a ceramic substrate of 0,7 mm x 10 cm^2	P_{tot}	max.	350	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 0,7 mm x 10 cm^2	$R_{th\ j\text{-}a}$	200	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	50	nA
D.C. current gain $I_C = 15$ mA; $V_{CE} = 5$ V	h_{FE}	min. typ.	60 100	
Transition frequency at f = 500 MHz $I_C = 15$ mA; $V_{CE} = 8$ V	f_T	typ.	7,5	GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 8$ V	C_c	typ.	0,7	pF
Emitter capacitance at f = 1 MHz $I_C = i_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	1,3	pF
Feedback capacitance $I_C = 0$; $V_{CE} = 8$ V	C_{re}	typ.	0,45	pF

Maximum unilateral power gain (s_{re} assumed to be ZERO)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{[1-|s_{ie}|^2][1-|s_{oe}|^2]}$$

$I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	G_{UM}	typ.	12,5	dB
Noise figure at f = 2 GHz; $R_S = 60\ \Omega$; $T_{amb} = 25$ °C				
$I_C = 5$ mA; $V_{CE} = 8$ V	F	typ.	2,5	dB
$I_C = 15$ mA; $V_{CE} = 8$ V	F	typ.	3,0	dB

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor primarily intended for final stages in MATV system amplifiers. This device is also suitable for use in low power band IV and V equipment. Diffused emitter ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ¼″ capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Collector current (d.c.)	I_C	max.	300	mA
Total power dissipation up to T_{mb} = 110 °C	P_{tot}	max.	4,5	W
Operating junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 240 mA; V_{CE} = 15 V	f_T	typ.	4	GHz
Output voltage at d_{im} = −60 dB (see Figs 2 and 12) I_C = 240 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	1,6	V

MECHANICAL DATA

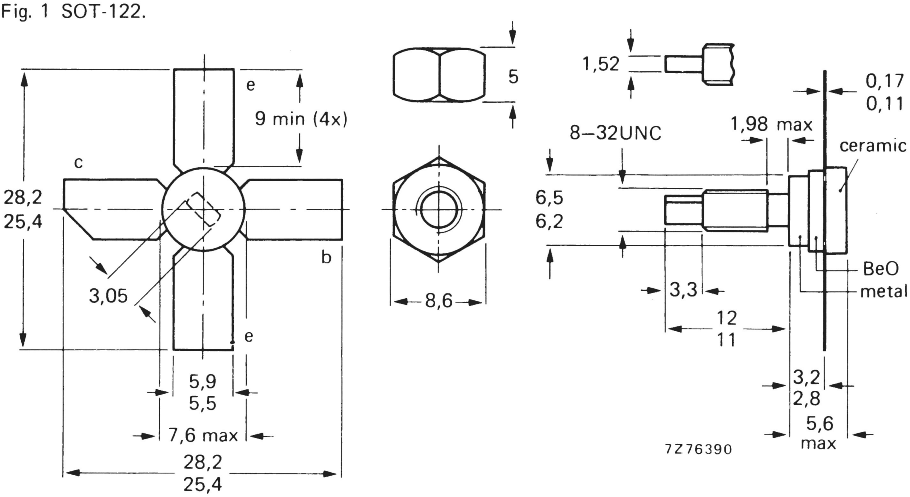
SOT-122 (see Fig. 1).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.


e
9 min (4x)
c
28,2
25,4
b
3,05
e
5,9
5,5
7,6 max
28,2
25,4
5
8,6
1,52
8–32UNC
1,98 max
0,17
0,11
ceramic
6,5
6,2
BeO
metal
3,3
12
11
3,2
2,8
5,6
max
7Z76390

Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (d.c.)	I_C	max.	300	mA
Total power dissipation up to T_{mb} = 110 °C (see Fig. 7)	P_{tot}	max.	4,5	W
Storage temperature	T_{stg}	–65 to +	150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	20,0	K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W*

---

* K/W is SI unit for °C/W.

CHARACTERISTICS

$T_{amb} = 25\ ^{o}C$

Collector cut-off current $I_E = 0;\ V_{CB} = 15$ V	I_{CBO}	<	50 μA
D.C. current gain* $I_C = 240$ mA; $V_{CE} = 15$ V	h_{FE}	>	25
Transition frequency at f = 500 MHz* $I_C = 240$ mA; $V_{CE} = 15$ V	f_T	typ.	4 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0;\ V_{CB} = 15$ V	C_c	typ.	3,8 pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0;\ V_{EB} = 0{,}5$ V	C_e	typ.	20 pF
Feedback capacitance at f = 1 MHz $I_C = 0;\ V_{CE} = 15$ V	C_{re}	typ.	2,3 pF
Collector-stud capacitance**	C_{cs}	typ.	0,8 pF

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)\,(1-|s_{oe}|^2)}$$

$I_C = 240$ mA; $V_{CE} = 15$ V; f = 800 MHz	G_{UM}	typ.	13 dB

Output voltage at $d_{im} = -60$ dB (see Figs 2 and 12)
(DIN 45004B, par. 6.3: 3-tone)
$I_C = 240$ mA; $V_{CE} = 15$ V; $R_L = 75\ \Omega$

$V_p = V_o$ at $d_{im} = -60$ dB; $f_p = 795{,}25$ MHz
$V_q = V_o - 6$ dB ; $f_q = 803{,}25$ MHz
$V_r = V_o - 6$ dB ; $f_r = 805{,}25$ MHz

measured at $f_{(p+q-r)} = 793{,}25$ MHz	V_o	typ.	1,6 V

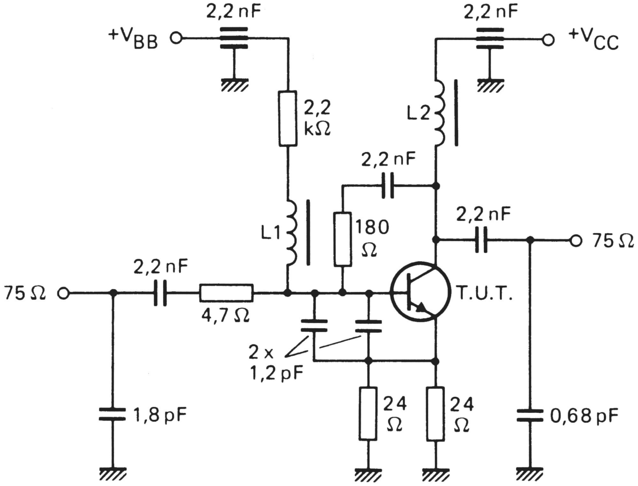


Fig. 2 Intermodulation distortion MATV test circuit. Power gain at f = 40 MHz to 860 MHz is typical 7 dB.

L1 = L2 = 5 μH micro choke.

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* Measured under pulse conditions.

** Measured with emitter and base grounded.

s-parameters (common emitter) at V_{CE} = 7,5 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
50	40	0,66/–135,7°	0,02/41,1°	30,4/124,0°	0,64/ –79,0°
	100	0,77/–164,0°	0,03/33,6°	14,8/101,2°	0,45/–125,3°
	200	0,80/–176,3°	0,03/44,1°	7,7/ 89,1°	0,39/–147,9°
	500	0,80/ 170,2°	0,06/55,3°	3,1/ 70,3°	0,38/–159,5°
	800	0,78/ 157,0°	0,09/60,5°	2,0/ 57,2°	0,42/–165,6°
	1000	0,78/ 152,4°	0,11/61,8°	1,6/ 48,1°	0,43/–167,6°
	1200	0,75/ 142,7°	0,13/59,9°	1,4/ 41,1°	0,46/–171,2°
100	40	0,67/–146,1°	0,02/40,9°	33,5/121,5°	0,64/ –90,4°
	100	0,78/–167,5°	0,02/37,2°	15,6/100,4°	0,49/–134,4°
	200	0,80/–178,3°	0,03/47,0°	8,1/ 89,2°	0,45/–155,5°
	500	0,79/ 168,9°	0,06/60,4°	3,4/ 72,0°	0,43/–170,5°
	800	0,77/ 156,1°	0,09/62,0°	2,2/ 59,5°	0,44/–174,5°
	1000	0,77/ 151,5°	0,11/61,9°	1,8/ 51,5°	0,44/–178,5°
	1200	0,74/ 141,8°	0,14/59,4°	1,5/ 44,0°	0,46/–178,5°
150	40	0,68/–149,0°	0,02/40,8°	34,3/120,6°	0,64/ –94,6°
	100	0,78/–168,8°	0,02/38,8°	15,9/100,0°	0,50/–138,0°
	200	0,80/–179,0°	0,03/49,0°	8,2/ 89,2°	0,47/–158,2°
	500	0,79/ 168,5°	0,06/61,6°	3,4/ 72,5°	0,45/–173,2°
	800	0,77/ 155,8°	0,09/62,5°	2,2/ 60,3°	0,46/–177,1°
	1000	0,76/ 151,2°	0,12/62,1°	1,8/ 52,5°	0,46/ 177,1°
	1200	0,73/ 141,6°	0,14/59,1°	1,5/ 45,1°	0,47/ 177,1°
200	40	0,68/–150,7°	0,02/40,5°	34,7/120,0°	0,64/ –97,3°
	100	0,78/–169,7°	0,02/39,6°	15,9/ 99,7°	0,51/–140,4°
	200	0,80/–179,8°	0,03/50,1°	8,2/ 89,0°	0,49/–159,8°
	500	0,79/ 168,2°	0,06/62,1°	3,4/ 72,6°	0,47/–174,8°
	800	0,77/ 155,6°	0,09/62,6°	2,2/ 60,5°	0,47/–178,6°
	1000	0,76/ 150,9°	0,12/62,1°	1,8/ 52,9°	0,46/ 175,5°
	1200	0,73/ 141,4°	0,14/59,0°	1,5/ 45,3°	0,47/ 174,6°
250	40	0,69/–151,9°	0,02/40,1°	34,6/119,4°	0,63/ –99,4°
	100	0,79/–170,3°	0,02/39,9°	15,8/ 99,5°	0,52/–141,8°
	200	0,80/ 180,0°	0,03/51,0°	8,1/ 88,9°	0,49/–160,9°
	500	0,80/ 168,0°	0,06/62,5°	3,4/ 72,6°	0,47/–175,6°
	800	0,78/ 155,4°	0,09/62,8°	2,2/ 60,6°	0,48/–179,5°
	1000	0,77/ 150,8°	0,12/62,1°	1,8/ 53,0°	0,47/ 174,5°
	1200	0,73/ 141,3°	0,14/58,9°	1,5/ 45,6°	0,47/ 173,9°
300	40	0,69/–152,9°	0,02/39,7°	34,4/118,9°	0,62/–101,2°
	100	0,79/–170,8°	0,02/40,1°	15,5/ 99,2°	0,52/–143,2°
	200	0,80/ 179,6°	0,03/51,5°	8,0/ 88,8°	0,50/–161,7°
	500	0,80/ 167,9°	0,06/62,8°	3,4/ 72,5°	0,48/–176,2°
	800	0,78/ 155,3°	0,09/62,9°	2,2/ 60,5°	0,48/+179,8°
	1000	0,77/ 150,6°	0,12/62,1°	1,8/ 53,0°	0,47/ 173,9°
	1200	0,74/ 141,1°	0,14/59,1°	1,5/ 45,5°	0,48/ 173,4°

s-parameters (common emitter) at V_{CE} = 15 V.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
50	40	0,63/−132,3°	0,02/41,8°	33,5/126,6°	0,62/ −72,9°
	100	0,75/−161,1°	0,02/34,0°	16,4/103,0°	0,41/−115,2°
	200	0,78/−174,8°	0,03/40,7°	8,6/ 90,1°	0,34/−139,4°
	500	0,78/ 169,9°	0,06/56,8°	3,6/ 71,4°	0,34/−153,8°
	800	0,77/ 157,5°	0,08/60,9°	2,3/ 57,6°	0,37/−157,4°
	1000	0,74/ 150,3°	0,10/61,8°	1,9/ 48,8°	0,40/−160,3°
	1200	0,73/ 143,2°	0,12/61,0°	1,5/ 41,2°	0,42/−162,9°
100	40	0,63/−140,5°	0,02/41,6°	36,4/125,0°	0,61/ −82,0°
	100	0,76/−164,8°	0,02/37,3°	17,5/102,3°	0,44/−126,8°
	200	0,78/−176,8°	0,03/46,7°	9,1/ 90,3°	0,39/−149,8°
	500	0,77/ 168,8°	0,06/60,3°	3,8/ 72,6°	0,38/−164,2°
	800	0,76/ 156,7°	0,09/62,1°	2,4/ 60,0°	0,39/−168,6°
	1000	0,73/ 149,6°	0,11/61,7°	2,0/ 51,2°	0,40/−170,8°
	1200	0,72/ 142,6°	0,13/60,2°	1,7/ 44,6°	0,42/−172,6°
150	40	0,64/−143,2°	0,02/41,1°	37,6/123,9°	0,60/ −86,5°
	100	0,76/−166,0°	0,02/38,3°	17,9/101,8°	0,45/−131,0°
	200	0,78/−177,5°	0,03/48,1°	9,3/ 90,2°	0,41/−153,1°
	500	0,77/ 168,2°	0,06/61,2°	3,9/ 73,1°	0,40/−167,7°
	800	0,76/ 156,3°	0,09/62,2°	2,5/ 60,6°	0,40/−172,0°
	1000	0,72/ 149,2°	0,11/61,5°	2,0/ 52,2°	0,41/−174,6°
	1200	0,72/ 142,2°	0,13/59,5°	1,7/ 45,3°	0,42/−176,1°
200	40	0,65/−144,0°	0,02/40,6°	38,5/122,8°	0,60/ −90,2°
	100	0,76/−166,7°	0,02/39,0°	18,0/101,2°	0,46/−133,7°
	200	0,78/−177,9°	0,03/49,1°	9,3/ 89,9°	0,42/−155,2°
	500	0,77/ 168,0°	0,06/61,6°	3,9/ 73,3°	0,41/−169,7°
	800	0,76/ 156,1°	0,09/62,3°	2,5/ 60,9°	0,41/−174,0°
	1000	0,72/ 149,1°	0,11/61,5°	2,1/ 52,8°	0,42/−175,7°
	1200	0,71/ 142,1°	0,13/59,2°	1,7/ 45,8°	0,42/−177,3°
250	40	0,66/−144,9°	0,02/40,7°	38,6/122,1°	0,60/ −91,6°
	100	0,76/−167,0°	0,02/39,2°	18,0/100,8°	0,46/−135,4°
	200	0,78/−178,1°	0,03/49,5°	9,3/ 89,7°	0,43/−156,2°
	500	0,77/ 167,8°	0,06/62,0°	3,9/ 73,2°	0,42/−170,3°
	800	0,76/ 156,1°	0,09/62,4°	2,5/ 61,0°	0,41/−174,8°
	1000	0,72/ 148,9°	0,11/61,5°	2,0/ 52,6°	0,41/−177,2°
	1200	0,72/ 141,8°	0,14/58,8°	1,7/ 45,7°	0,41/−178,3°
300	40	0,67/−145,2°	0,02/40,1°	38,7/121,3°	0,59/ −93,3°
	100	0,77/−167,3°	0,02/39,0°	17,9/100,3°	0,46/−136,5°
	200	0,79/−178,2°	0,03/49,6°	9,2/ 89,4°	0,43/−156,8°
	500	0,78/ 167,7°	0,06/62,0°	3,9/ 72,9°	0,42/−170,6°
	800	0,76/ 156,1°	0,09/62,4°	2,5/ 60,8°	0,41/−174,7°
	1000	0,73/ 148,8°	0,11/61,4°	2,0/ 52,5°	0,41/−177,4°
	1200	0,72/ 142,0°	0,14/59,2°	1,7/ 45,7°	0,42/+177,4°

Conditions for Figs 3 and 4:
V_{CE} = 15 V; I_C = 240 mA;
T_{amb} = 25 °C.

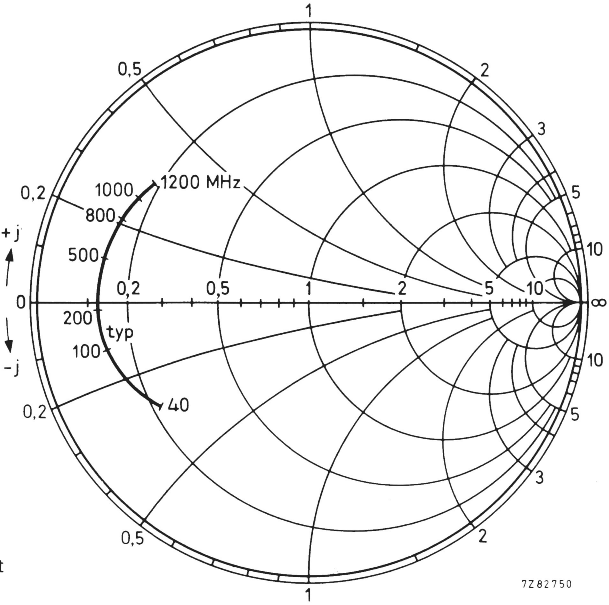


Fig. 3 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

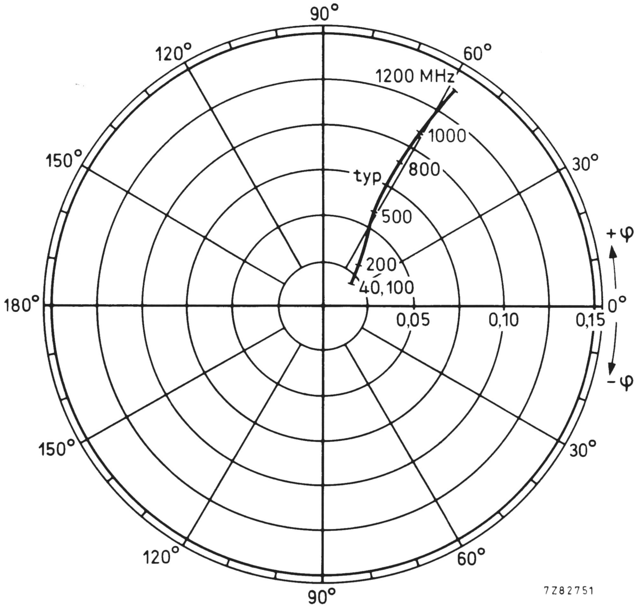


Fig. 4 Reverse transmission coefficient s_{re}.

Conditions for Figs 5 and 6:
V_{CE} = 15 V; I_C = 240 mA;
T_{amb} = 25 °C.

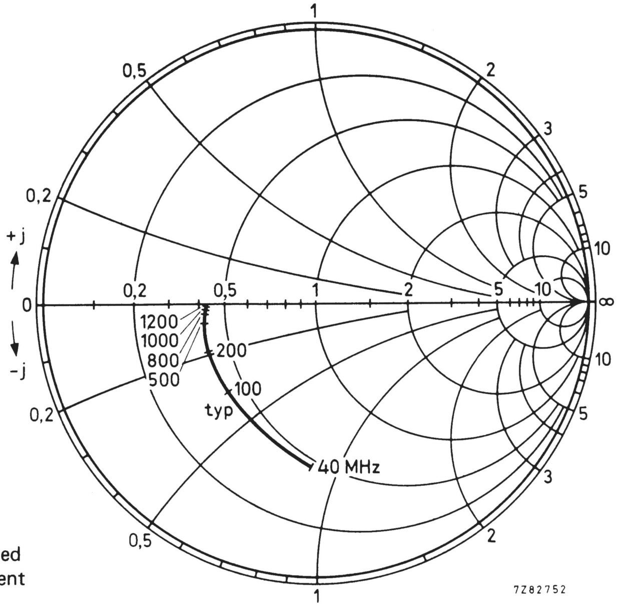


Fig. 5 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

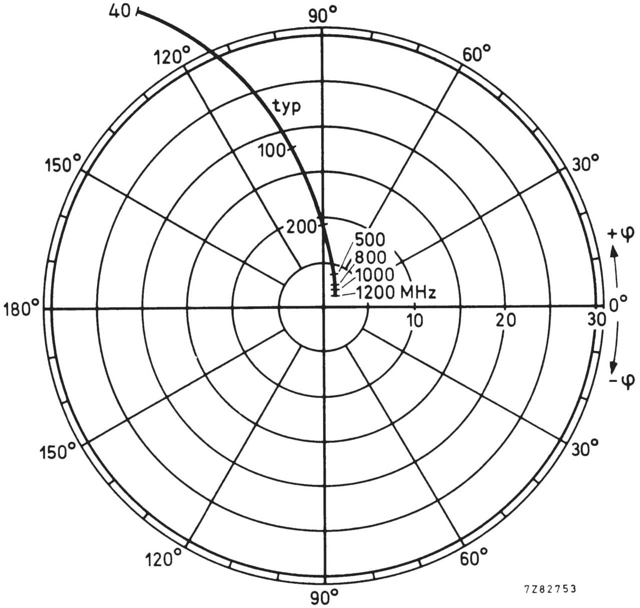


Fig. 6 Forward transmission coefficient s_{fe}.

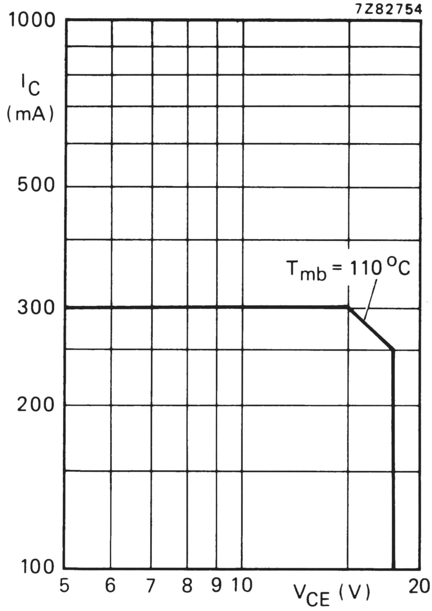


Fig. 7 D.C. SOAR.

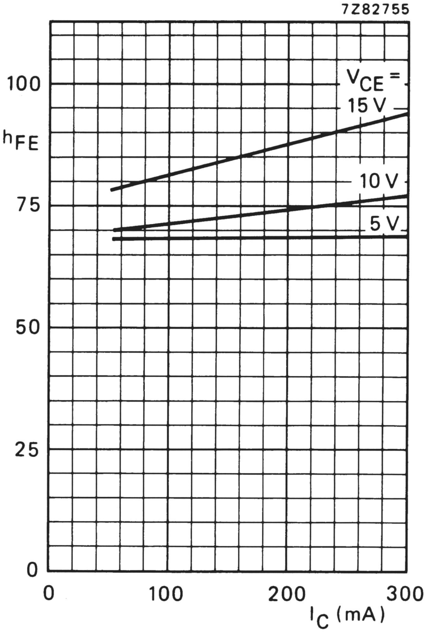


Fig. 8 T_j = 25 °C; typical values.

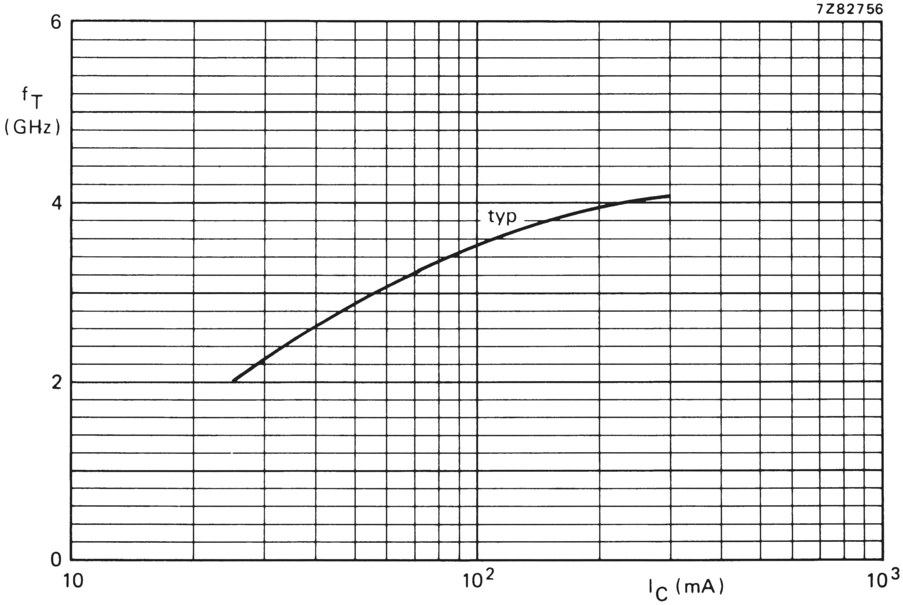


Fig. 9 V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C.

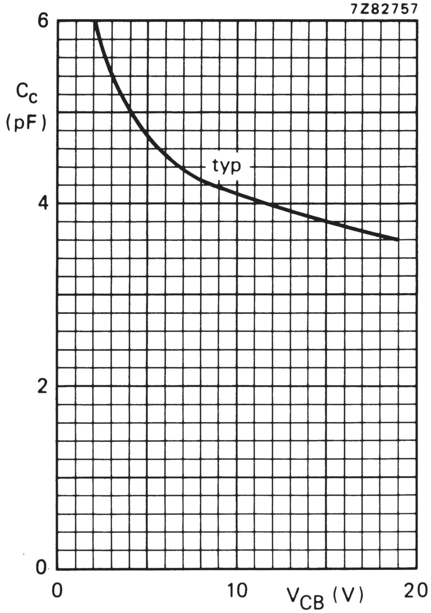


Fig. 10.

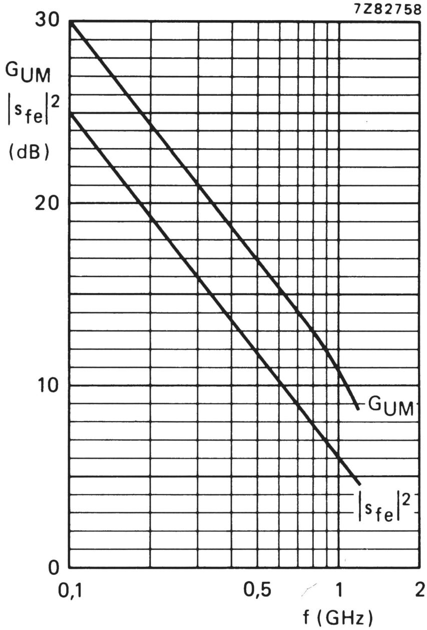


Fig. 11.

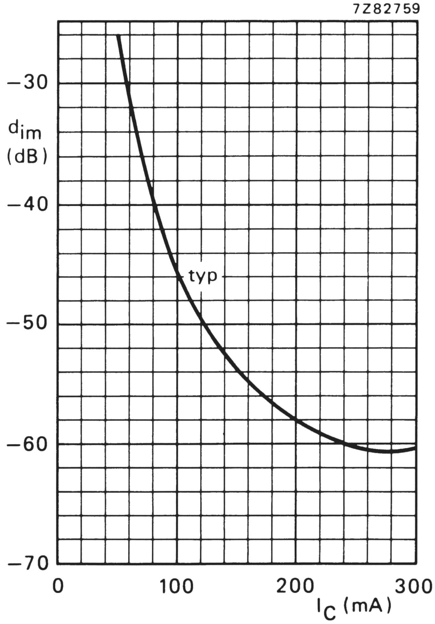


Fig. 12.

Conditions for Figs 10, 11 and 12:

Fig. 10 $I_E = I_e = 0$; $T_{amb} = 25\ ^oC$.

Fig. 11 $V_{CE} = 15$ V; $I_C = 240$ mA; $T_{amb} = 25\ ^oC$; typical values.

Fig. 12 $V_{CE} = 15$ V; $V_o = 1{,}6$ V; $f_{(p+q-r)} = 793{,}25$ MHz; $T_{amb} = 25\ ^oC$; measured in MATV test circuit (see Fig. 2).

N-P-N SILICON MICROWAVE TRANSISTOR

The BFR49 is a microwave transistor featuring a high transition frequency and low noise. A miniature ceramic encapsulation is used for compatibility with stripline and microwave circuits. It is suitable for amplifiers up to S-band frequencies in instrumentation and microwave systems.

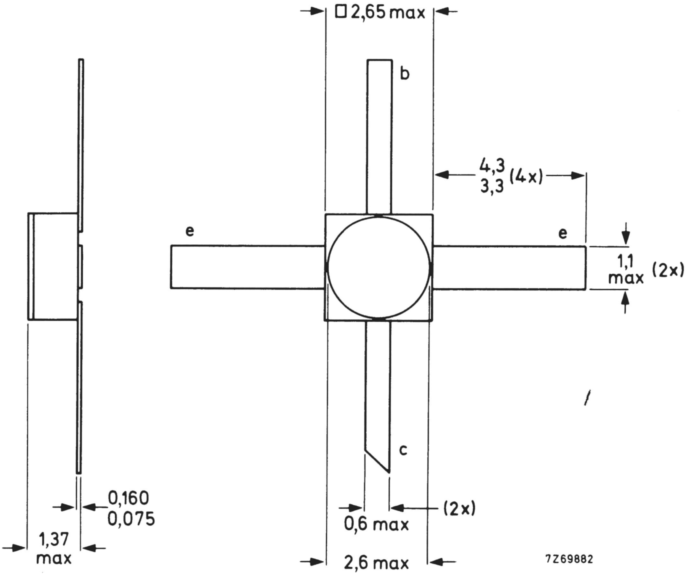
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max	20	V
Collector-emitter voltage (open base)	V_{CEO}	max	15	V
Collector current (d.c.)	I_C	max	25	mA
Total power dissipation up to T_{amb} = 110 °C	P_{tot}	max	180	mW
Transition frequency I_C = 14 mA; V_{CE} = 10 V	f_T	typ	5	GHz
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 10 V; f = 1 GHz	F	typ	2,5	dB
Transducer power gain I_C = 14 mA; V_{CE} = 10 V; f = 1 GHz	$\vert s_{fe}\vert^2$	typ	15,5	dB

MECHANICAL DATA

Dimensions in mm

SOT-100



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter; I_C = 10 μA)	V_{CBO}	max	20	V
Collector-emitter voltage (open base; I_C = 10 mA)	V_{CEO}	max	15	V
Emitter-base voltage (open collector; I_E = 10 μA)	V_{EBO}	max	2	V
Collector current (d.c.)	I_C	max	25	mA
Total power dissipation up to T_{amb} = 110 °C	P_{tot}	max	180	mW
Storage temperature	T_{stg}	−65 to + 200		°C
Junction temperature	T_j	max	200	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0,5	°C/mW

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 10 V	I_{CBO}	<	50	nA
D.C. current gain * I_C = 14 mA; V_{CE} = 10 V	h_{FE}	>	25	
Transition frequency * I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz	f_T	typ	5	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ	0,35	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; V_{EB} = 0,5 V	C_e	typ	1,1	pF
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 10 V	C_{re}	typ	0,3	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 10 V; f = 1 GHz	F	typ	2,5	dB
I_C = 2 mA; V_{CE} = 10 V; f = 4 GHz	F	typ	6,5	dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

I_C = 14 mA; V_{CE} = 10 V; f = 1 GHz	G_{UM}	typ	17,0	dB
I_C = 14 mA; V_{CE} = 10 V; f = 4 GHz	G_{UM}	typ	6,5	dB

Transducer power gain

I_C = 14 mA; V_{CE} = 10 V; f = 1 GHz	$|s_{fe}|^2$	typ	15,5	dB
I_C = 14 mA; V_{CE} = 10 V; f = 4 GHz	$|s_{fe}|^2$	typ	3,5	dB

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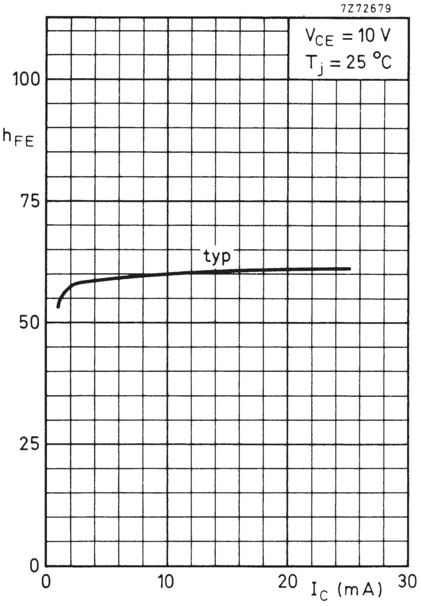
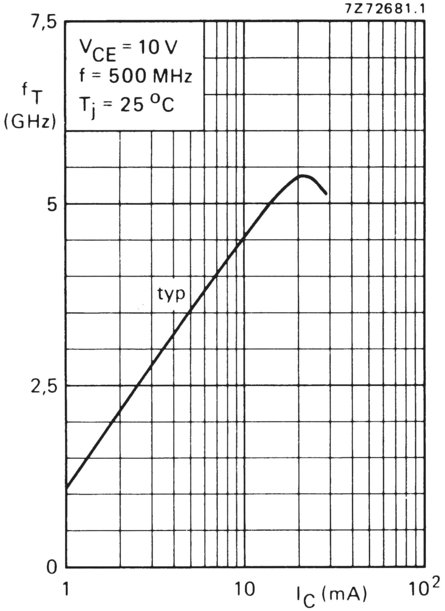
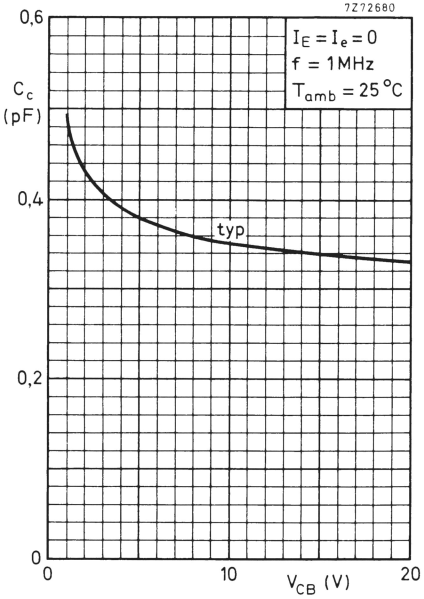
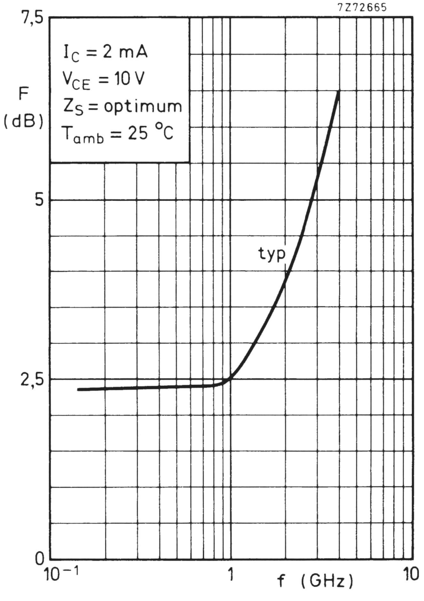
* Measured under pulse conditions.

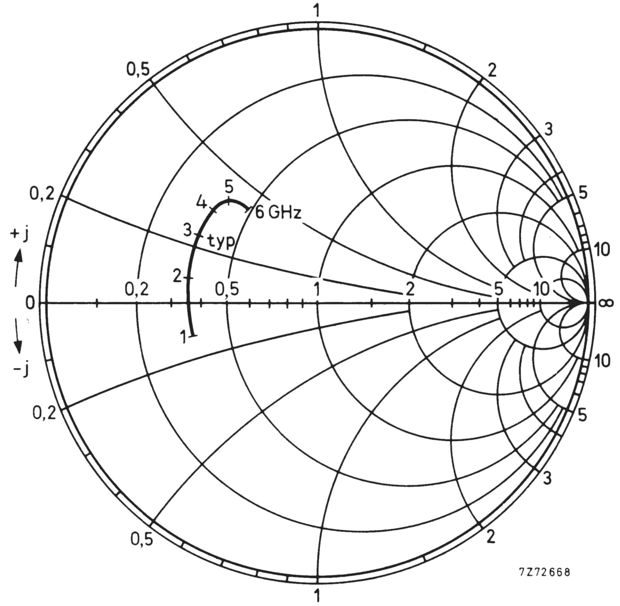

7Z72679
V_{CE} = 10 V
T_j = 25 °C
h_{FE}
100
75
50
25
0
typ
0
10
20
30
I_C (mA)


7Z72681.1
V_{CE} = 10 V
f = 500 MHz
T_j = 25 °C
f_T (GHz)
7,5
5
2,5
0
typ
1
10
10^2
I_C (mA)


7Z72680
$I_E = I_e = 0$
f = 1 MHz
T_{amb} = 25 °C
C_c (pF)
0,6
0,4
0,2
0
typ
0
10
20
V_{CB} (V)

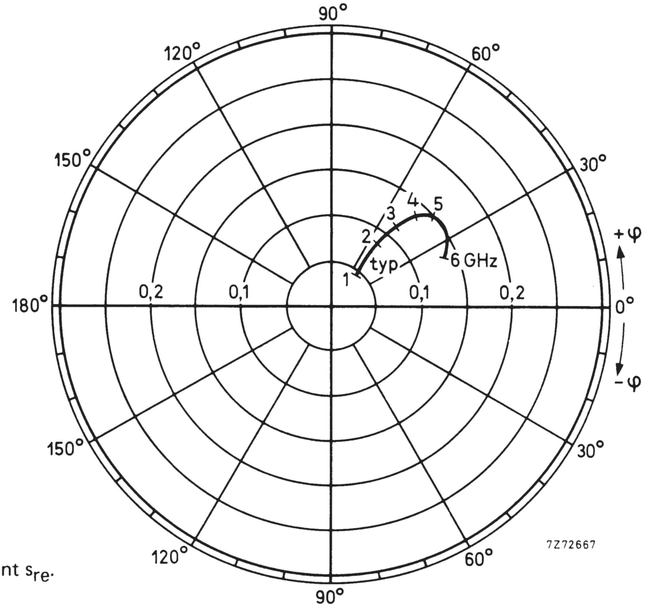

7Z72665
I_C = 2 mA
V_{CE} = 10 V
Z_S = optimum
T_{amb} = 25 °C
F (dB)
7,5
5
2,5
0
typ
10^{-1}
1
10
f (GHz)

V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C



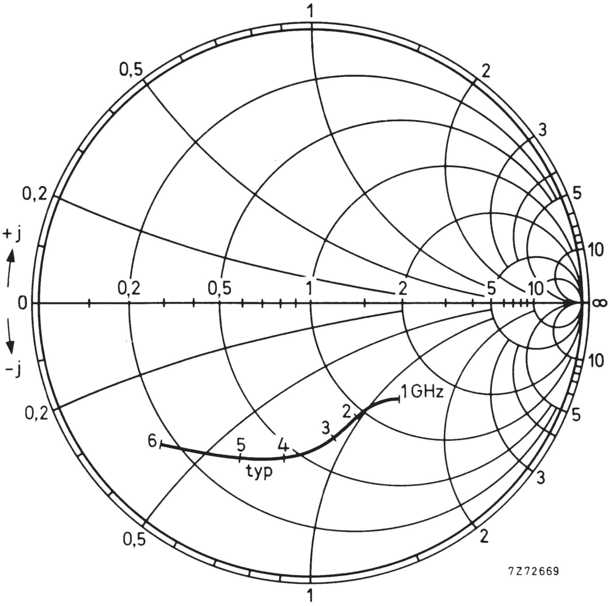
Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C



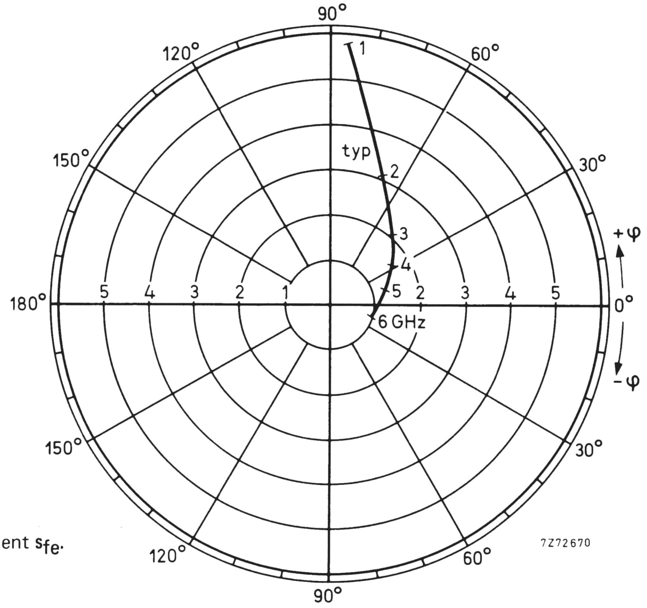
Reverse transmission coefficient s_{re}.

V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C

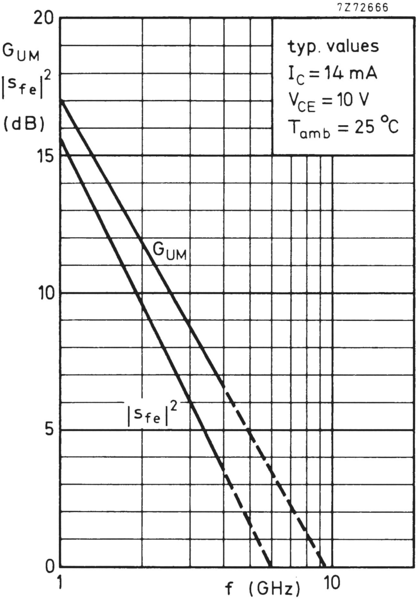


Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

V_{CE} = 10 V
I_C = 14 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}.


7Z72666
G_{UM}
$|s_{fe}|^2$
(dB)
20
15
10
5
0
typ. values
$I_C = 14$ mA
$V_{CE} = 10$ V
$T_{amb} = 25$ °C
G_{UM}
$|s_{fe}|^2$
1
10
f (GHz)

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a capstan envelope. The transistor has extremely good intermodulation properties and high power gain.

The device is primarily intended for:

a Final and driver stages of channel and band aerial amplifiers with high output power for band I, II, III and IV/V (40-860 MHz).
b Final and driver stages of wideband amplifiers (40-230 MHz).
c Final stages of the wideband vertical amplifier in high-speed oscilloscopes.
d Frequency multiplier and oscillator circuits.

QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (peak value)	I_{CM}	max.	500	mA
Total power dissipation up to T_{mb} = 60 °C; f ⩾ 1 MHz	P_{tot}	max.	3,5	W
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 75 mA; V_{CE} = 20 V	f_T	>	1200	MHz
Output power at f = 200 MHz I_C = 70 mA; V_{CE} = 20 V; d_{im} = −30 dB	P_o	typ.	150	mW
Power gain at f = 200 MHz I_C = 70 mA; V_{CE} = 20 V	G_p	typ.	16	dB

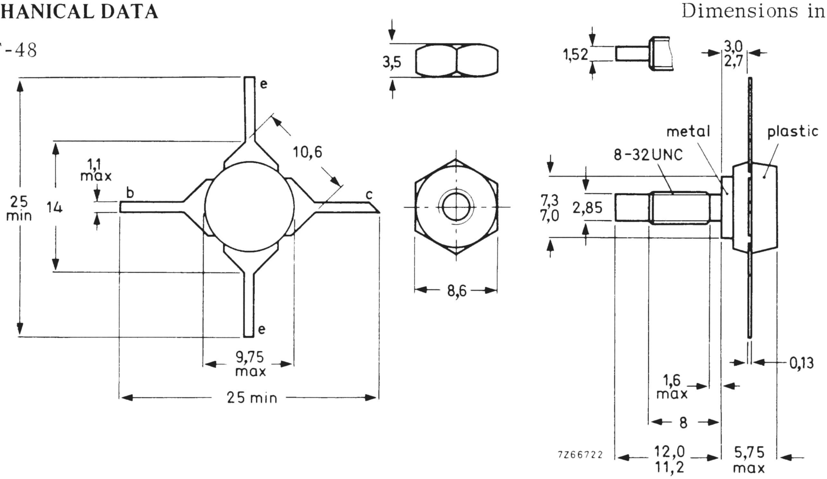
MECHANICAL DATA (see page 2)

CAUTION. These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.

Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V	1)
Collector-emitter voltage (R_{BE} = 10 Ω; peak value)	V_{CERM}	max.	40	V	2)
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V	2)
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V	3)

Currents

Collector current (d.c.)	I_C	max.	200	mA
Collector current (peak value) f > 1 MHz	I_{CM}	max.	500	mA

Power dissipation (f > 1 MHz; see SOAR)

Total power dissipation up to T_{mb} = 60 °C	P_{tot}	max.	3,5	W

Temperatures

Storage temperature	T_{stg}		-40 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	25	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,5	°C/W

---

1) at I_C = 100 μA.　2) at I_C = 10 mA.　3) at I_E = 100 μA.

CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	10	µA
Saturation voltage				
$I_C = 100$ mA; $I_B = 10$ mA	V_{CEsat}	<	0,75	V
D.C. current gain				
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 150$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	<	4,5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 10$ mA; $V_{CE} = 20$ V; $T_{mb} = 25\ ^oC$	C_{re}	typ.	1,7	pF
Noise figure at f = 200 MHz				
$I_C = 40$ mA; $V_{CE} = 20$ V; $R_S = 75\ \Omega$; $T_{mb} = 25\ ^oC$	F	typ.	6	dB
Transition frequency at f = 500 MHz				
$I_C = 15$ mA; $V_{CE} = 20$ V	f_T	typ.	1000	MHz
$I_C = 75$ mA; $V_{CE} = 20$ V	f_T	>	1200	MHz
$I_C = 150$ mA; $V_{CE} = 20$ V	f_T	typ.	1200	MHz
Output power at f = 200 MHz; $T_{mb} = 25\ ^oC$				
$I_C = 70$ mA; $V_{CE} = 20$ V; VSWR at output < 2 $f_p = 202$ MHz; $f_q = 205$ MHz; $d_{im} = -30$ dB measured at $f_{(2q-p)} = 208$ MHz (channel 9)	P_o	> typ.	130 150	mW mW
Output power at f = 800 MHz; $T_{mb} = 25\ ^oC$				
$I_C = 70$ mA; $V_{CE} = 20$ V; VSWR at output < 2 $f_p = 798$ MHz; $f_q = 802$ MHz; $d_{im} = -30$ dB measured at $f_{(2q-p)} = 806$ MHz (channel 62)	P_o	> typ.	70 90	mW mW
Power gain (not neutralized) $T_{mb} = 25\ ^oC$				
$I_C = 70$ mA; $V_{CE} = 20$ V; f = 200 MHz	G_p	> typ.	15 16	dB dB
$I_C = 70$ mA; $V_{CE} = 20$ V; f = 800 MHz	G_p	typ.	6,5	dB

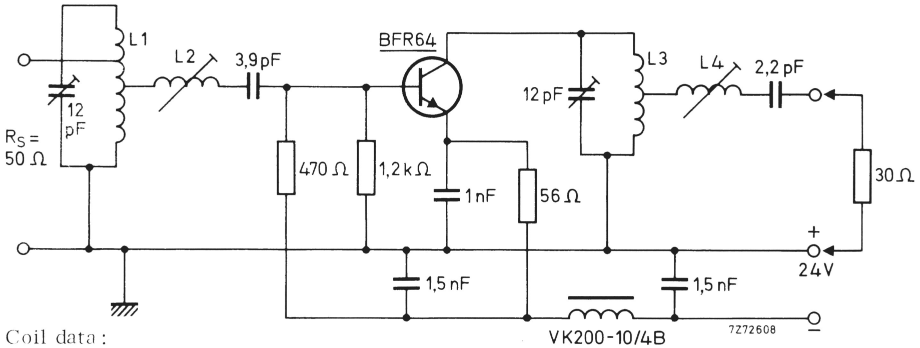
CHARACTERISTICS (continued)

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{mb} = 25 °C

   I_C = 70 mA; V_{CE} = 20 V; VSWR at output < 2
   f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 208 MHz (channel 9)

Test circuit:


L1
L2
3,9 pF
BFR64
L3
L4
2,2 pF
12 pF
12 pF
R_S = 50 Ω
470 Ω
1,2 kΩ
1 nF
56 Ω
30 Ω
+
24V
1,5 nF
1,5 nF
VK200-10/4B
−
7Z72608

Coil data:

L1 = 3 turns silver-plated Cu wire (1, 4 mm); winding pitch 2, 7 mm; int. dia. 8 mm;
taps at 0, 5 turn and 1, 5 turns from earth.
L2 = 5, 5 turns silver-plated Cu wire (1, 4 mm); winding pitch 2, 2 mm; int. dia. 8 mm
L3 = 3 turns silver-plated Cu wire (1, 4 mm); winding pitch 3, 3 mm; int. dia. 8 mm
L4 = 5, 5 turns silver-plated Cu wire (1, 4 mm); winding pitch 2, 2 mm; int. dia. 11 mm

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current-voltage clipping.
The maximum undistorted output power is realized, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

in which V_{CEK} is the high-frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short-circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 220\ \Omega$; $C_L = -4$ pF.

Adjustment procedure

1. Remove the transistor and connect a dummy consisting of a 220 Ω resistor in parallel with a 4 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (VSWR = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band-pass curve.
The VSWR of the output will then, in most cases, be ≤ 2 over the whole channel. Corrections can be made by tuning L2; this will not disturb the band-pass curve.

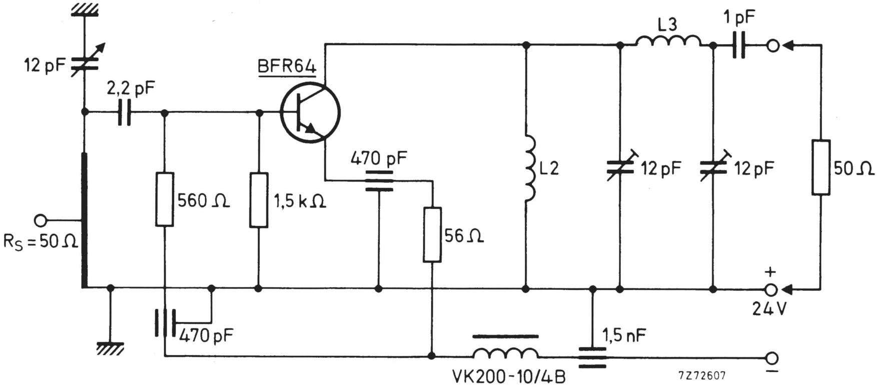
CHARACTERISTICS (continued)

Intermodulation characteristics

2. Output power at f = 800 MHz; T_{mb} = 25 °C

I_C = 70 mA; V_{CE} = 20 V; VSWR at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (channel 62)

Test circuit:



Coil data:

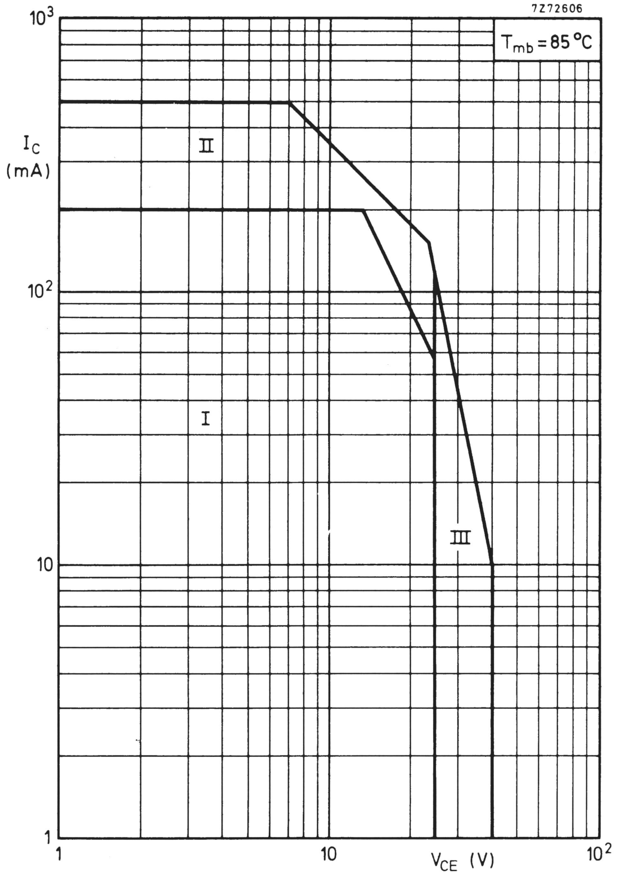
L1 = 25 mm x 7 mm x 0,85 mm silver-plated Cu strip
Tap of the input at 5 mm from earth.
L2 = 13 turns enamelled Cu wire (0,6 mm); int. dia. 8 mm
L3 = 1,5 turns Cu wire (1,3 mm); int. dia. 8 mm

Basis of adjustment

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

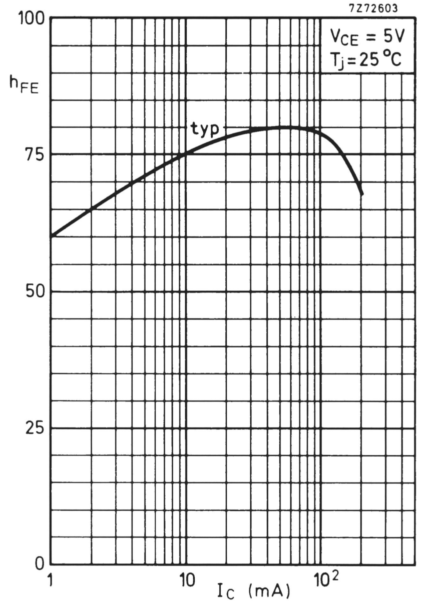
$$P_o = \frac{I_C(V_{CE} - V_{CEK})}{2} = 480 \text{ mW}.$$

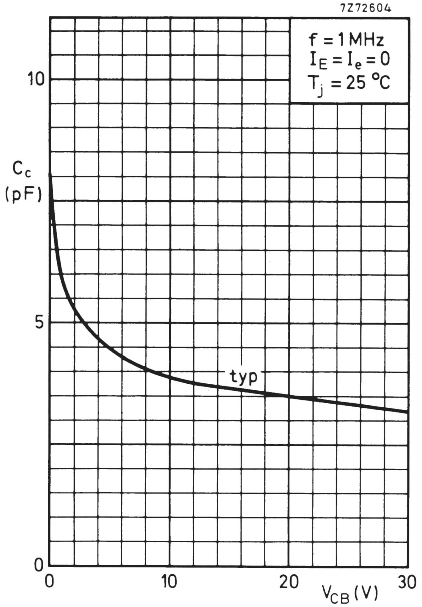
The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 480 mW. With this adjusting method, care must be taken that the transistor is not damaged by second breakdown (the voltage swing may not exceed the rated V_{CER} value). Therefore as soon as clipping occurs, the increase of the input signal should be stopped until the clipping has been eliminated. After this adjustment has been made no further change may be made in the output circuit. Adjust the input circuit for maximum power gain and good band-pass curve. The VSWR of the output is then ≤ 2 over the whole channel.

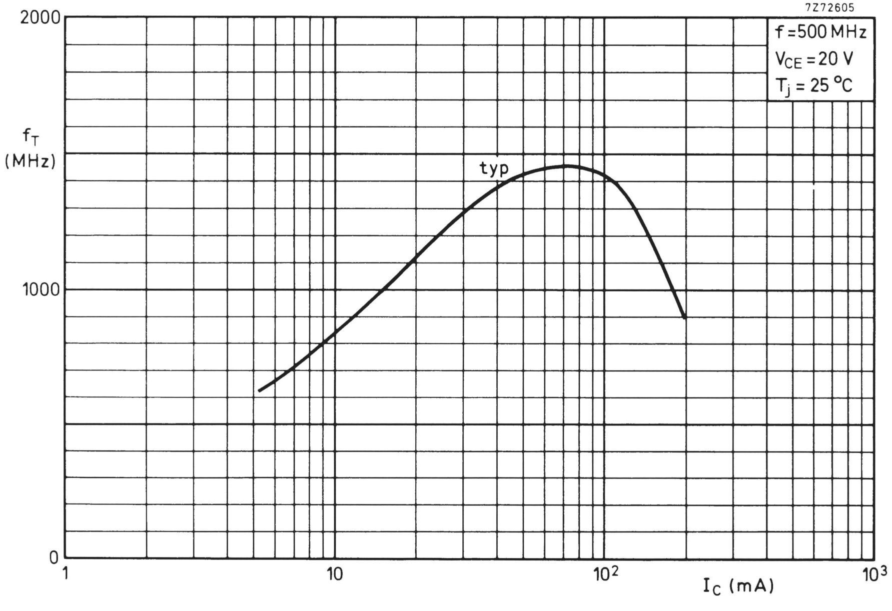


Safe Operating Area with the transistor forward biased

I Region of permissible d.c. operation
II Permissible extension for repetitive pulsed operation; f > 1 MHz
III Repetitive pulse operation in this region is allowable, provided $R_{BE} < 10\ \Omega$ and f > 1 MHz


7Z72603
100
75
50
25
0
h_{FE}
typ
V_{CE} = 5V
T_j = 25 °C
1
10
10^2
I_C (mA)


7Z72604
10
5
0
C_c
(pF)
typ
f = 1 MHz
I_E = I_e = 0
T_j = 25 °C
0
10
20
30
V_{CB} (V)


7Z72605
2000
1000
0
f_T
(MHz)
typ
f = 500 MHz
V_{CE} = 20 V
T_j = 25 °C
1
10
10^2
10^3
I_C (mA)

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter silicon transistor in a capstan envelope. The transistor has extremely good intermodulation properties and high power gain.

The device is primarily intended for channel amplifiers in aerial amplifier systems as well as other applications where an excellent f_T linearity and higher signal handling capabilities than available in existing devices are required.

QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (peak value)	I_{CM}	max.	1000	mA
Junction temperature	T_j	max.	200	°C
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	15	°C/W
Transition frequency at f = 500 MHz $I_C = 200$ mA; $V_{CE} = 20$ V	f_T	>	1200	MHz
Output power at f = 200 MHz $I_C = 200$ mA; $V_{CE} = 20$ V; $d_{im} = -30$ dB	P_o	typ.	450	mW
Power gain at f = 200 MHz $I_C = 200$ mA; $V_{CE} = 20$ V	G_p	typ.	19	dB

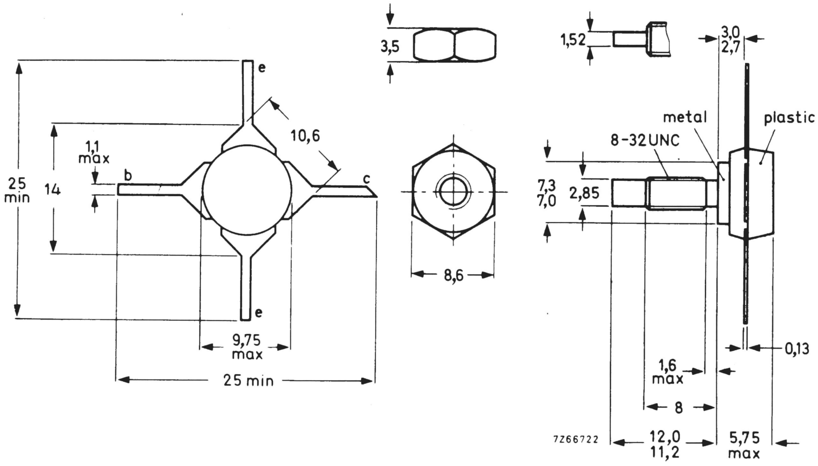
MECHANICAL DATA (see page 2)

CAUTION. These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

SOT-48


3,5
1,52
3,0
2,7
e
10,6
1,1 max
b
c
25 min
14
metal
plastic
8-32UNC
7,3
7,0
2,85
8,6
e
9,75 max
25 min
0,13
1,6 max
8
7Z66722
12,0
11,2
5,75 max

When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min.	0,75 Nm (7,5 kg cm)	Diameter of clearance hole in heatsink: max. 4,17 mm. Mounting hole to have no burrs at either end.
	0,85 Nm (8,5 kg cm)	De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40 V
Collector-emitter voltage (R_{BE} = 10 Ω; peak value)	V_{CERM}	max.	40 V
Collector-emitter voltage (open base)	V_{CEO}	max.	25 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5 V
Collector current (d.c.)	I_C	max.	400 mA
Collector current (peak value) f > 1 MHz	I_{CM}	max.	1000 mA
Total power dissipation up to T_{mb} = 125 °C see also page 6	P_{tot}	max.	5 W
Storage temperature	T_{stg}		−65 to +200 °C
Junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$ =	15 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$ =	0,5 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 1 mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter voltage R_{BE} = 10 Ω, I_C = 5 mA	$V_{(BR)CER}$	>	40	V
open base, I_C = 5 mA	$V_{(BR)CEO}$	>	25	V
Emitter-base voltage open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	3.5	V
Collector cut-off current				
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100	μA
Saturation voltage				
I_C = 200 mA; I_B = 20 mA	V_{CEsat}	<	0.75	V
D.C. current gain				
I_C = 200 mA; V_{CE} = 20 V	h_{FE}	>	30	
I_C = 400 mA; V_{CE} = 20 V	h_{FE}	>	20	
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 20 V	C_c	<	10	pF
Feedback capacitance at f = 1 MHz				
I_C = 10 mA; V_{CE} = 20 V; T_{mb} = 25 °C	C_{re}	typ.	3.5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF
Transition frequency at f = 500 MHz				
I_C = 200 mA; V_{CE} = 20 V	f_T	>	1200	MHz
I_C = 400 mA; V_{CE} = 20 V	f_T	>	1000	MHz
Output power at f = 200 MHz; T_{mb} = 25 °C				
I_C = 200 mA; V_{CE} = 20 V; V.S.W.R. at output < 2 f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB measured at $f_{(2q-p)}$ = 208 MHz (channel 9)	P_o	typ.	450	mW
Power gain (not neutralized) T_{mb} = 25 °C				
I_C = 200 mA; V_{CE} = 20 V; f = 200 MHz	G_p	> typ.	15 19	dB dB
I_C = 200 mA; V_{CE} = 20 V; f = 800 MHz	G_p	typ.	4.5	dB

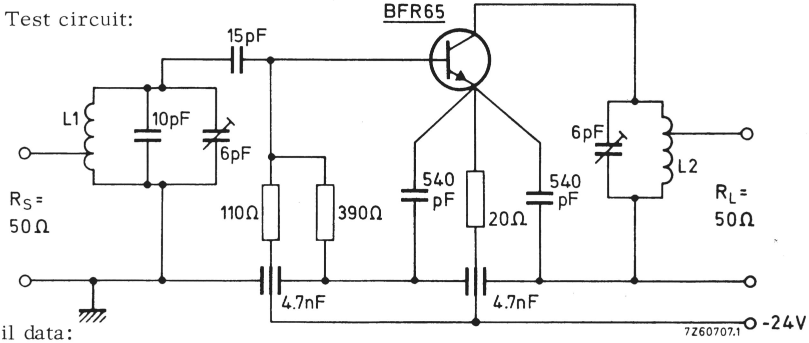
CHARACTERISTICS (continued)

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{mb} = 25 °C

   I_C = 200 mA; V_{CE} = 20 V; V.S.W.R. at output < 2
   f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 208 MHz (channel 9)

   Test circuit:


BFR65
15pF
L1
10pF
6pF
R_S =
50Ω
110Ω
390Ω
540 pF
20Ω
540 pF
6pF
L2
R_L =
50Ω
4.7nF
4.7nF
-24V
7Z60707.1

Coil data:

L1 = 1 turn silver plated Cu wire (1.4 mm); int. diam. 8 mm; tap at 0.75 turn from earth.

L2 = 3 turns silver plated Cu wire (1.4 mm); int. diam. 8 mm; winding pitch 2.7 mm; tap at 2.5 turns from earth.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current − voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

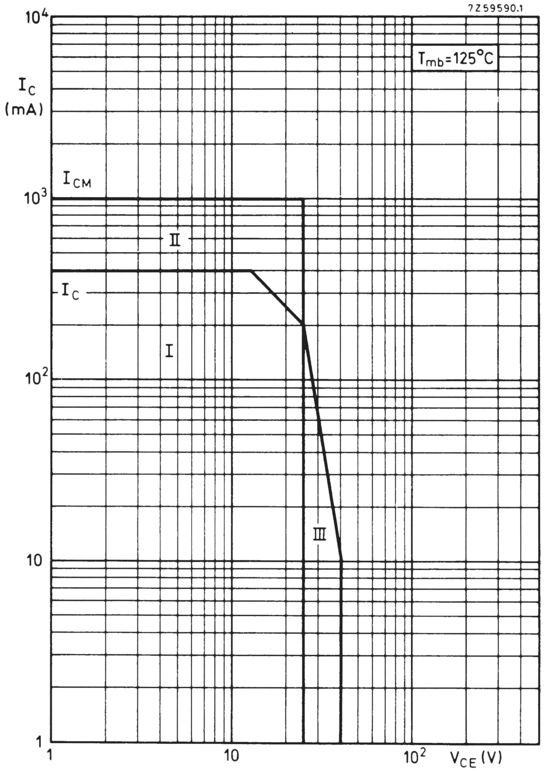
in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 91\ \Omega$; $C_L = -6.8$ pF.

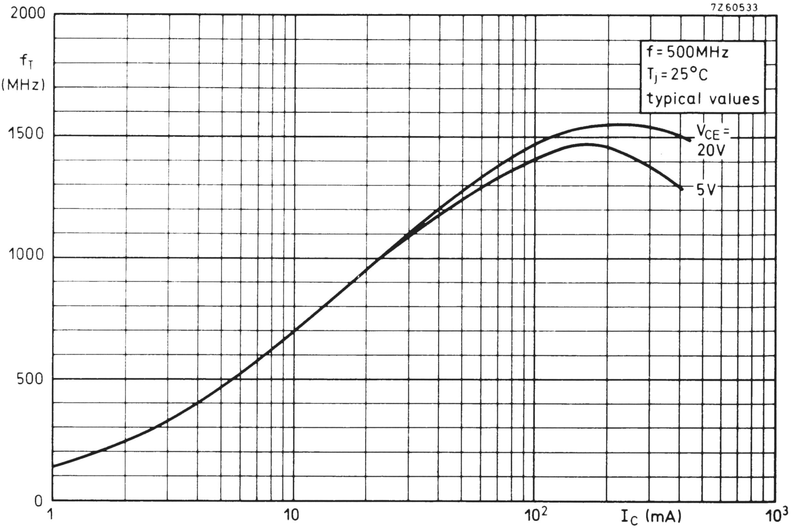
Adjustment procedure

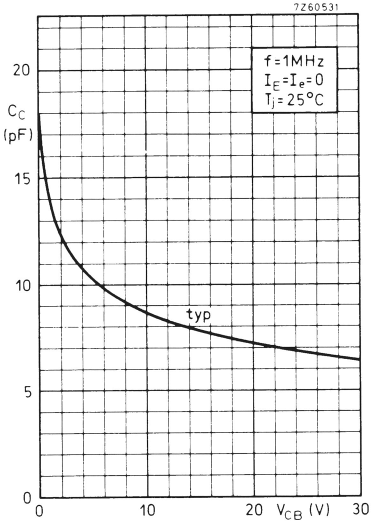
1. Remove the transistor and connect a dummy consisting of a 91 Ω resistor in parallel with a 6.8 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1)
After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.

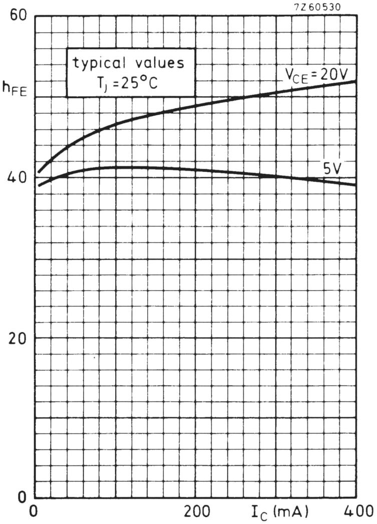


Safe Operating Area with the transistor forward biased

I Region of permissible d.c. operation
II Permissible extension for repetitive pulsed operation; f > 1 MHz
III Repetitive pulsed operation in this region is allowable, provided f > 1 MHz; $R_{BE} < 10\ \Omega$


7Z60533
2000
f_T
(MHz)
1500
1000
500
0
1
10
10^2
I_C (mA)
10^3
f = 500MHz
T_j = 25°C
typical values
V_{CE} = 20V
5V


7Z60531
20
C_c
(pF)
15
10
5
0
0
10
20
V_{CB} (V)
30
f = 1MHz
$I_E = I_e = 0$
T_j = 25°C
typ


7Z60530
60
h_{FE}
40
20
0
0
200
I_C (mA)
400
typical values
T_j = 25°C
V_{CE} = 20V
5V

THE BFR90A IS RECOMMENDED
FOR NEW DESIGN

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.
The transistor features low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz				
I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz				
I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,4	pF
Noise figure at optimum source impedance				
I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	2,4	dB
Max. unilateral power gain (see page 3)				
I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	19,5	dB
Intermodulation distortion at T_{amb} = 25 °C				
I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; V_o = 150 mV				
$f_{(p+q-r)}$ = 493,25 MHz (see page 4)	d_{im}	typ.	-60	dB

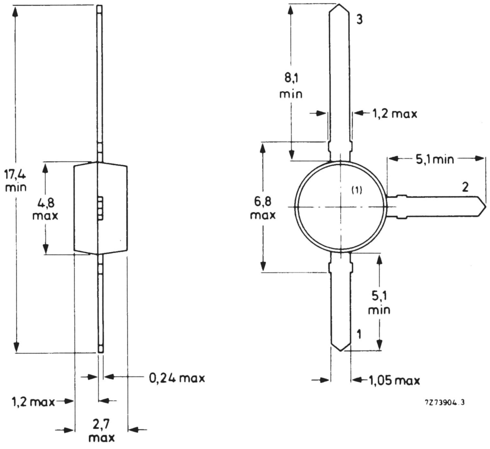
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages				
Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Current				
Collector current (d.c.)	I_C	max.	25	mA
Power dissipation				
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Temperatures				
Storage temperature	T_{stg}	-65 to +150		°C
Junction temperature	T_j	max.	150	°C

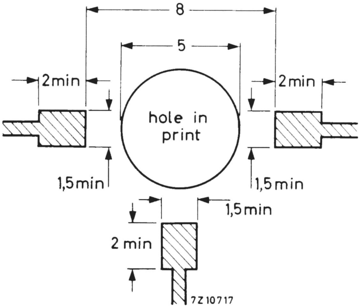
THERMAL RESISTANCE

From junction to ambient in free air

mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm	$R_{th\,j-a}$ =	0,5	°C/mW

*) Requirements for glas-fibre print

(dimensions in mm)



CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	$<$	50	nA
D.C. current gain [1]				
$I_C = 14$ mA; $V_{CE} = 10$ V	h_{FE}	$>$ typ.	40 90	
Transition frequency at f = 500 MHz [1]				
$I_C = 14$ mA; $V_{CE} = 10$ V	f_T	typ.	5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0,5	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0{,}5$ V	C_e	typ.	1,2	pF
Feedback capacitance at f = 1 MHz				
$I_C = 0$; $V_{CE} = 10$ V· $T_{amb} = 25$ °C	C_{re}	typ.	0,4	pF
Noise figure at optimum source impedance				
$I_C = 2$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	2,4	dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)(1-|s_{oe}|^2)}$$

$I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	19,5	dB

---

[1] Measured under pulse conditions.

CHARACTERISTICS (continued)

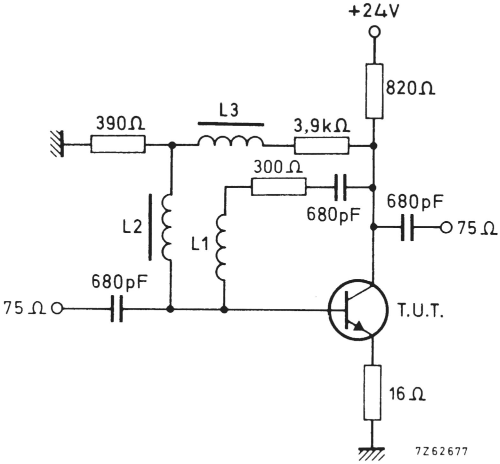
Intermodulation distortion at $T_{amb} = 25\,^{\circ}C$

$I_C = 14\,mA$; $V_{CE} = 10\,V$; $R_L = 75\,\Omega$; V.S.W.R. < 2

$V_p = V_o = 150\,mV$ at $f_p = 495,25\,MHz$
$V_q = V_o - 6\,dB$ at $f_q = 503,25\,MHz$
$V_r = V_o - 6\,dB$ at $f_r = 505,25\,MHz$

Measured at $f_{(p+q-r)} = 493,25\,MHz$	d_{im}	typ.	−60	dB

Intermodulation test circuit:


+24V
820Ω
390Ω
L3
3,9kΩ
300Ω
680pF
680pF
75Ω
L2
L1
680pF
75Ω
T.U.T.
16Ω
7Z62677

L1 = 4 turns Cu wire (0,35 mm); winding pitch 1 mm; int. diam. 4 mm
L2 and L3 5 μH (code number: 3122 108 20150)

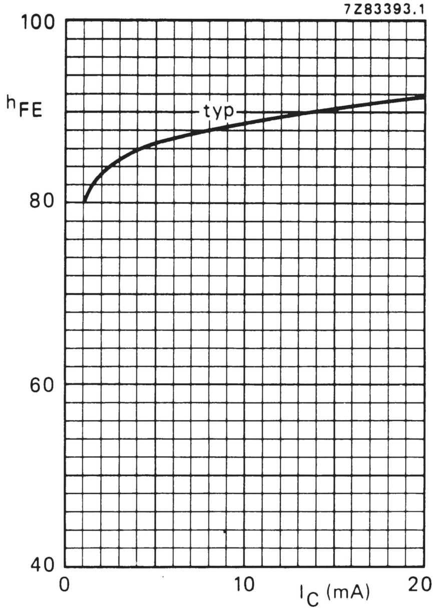
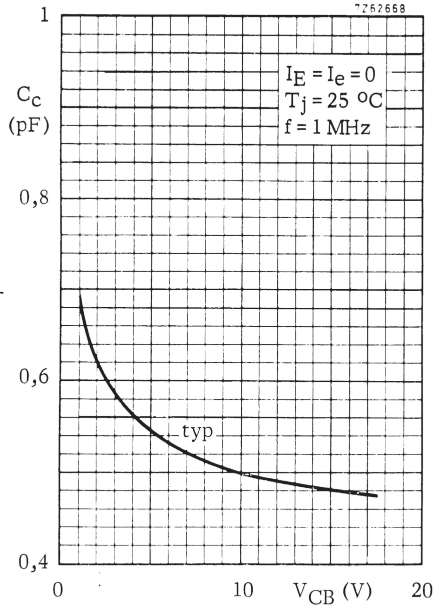
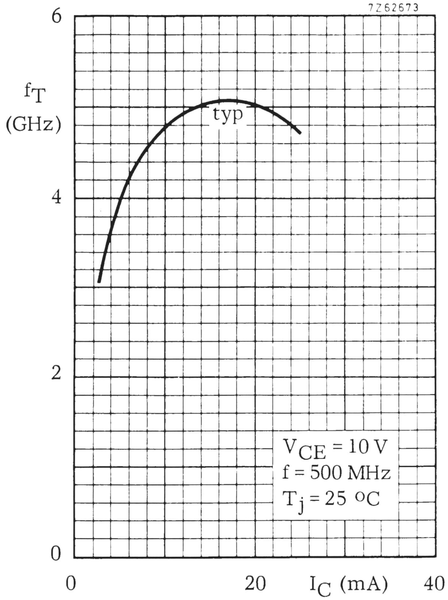
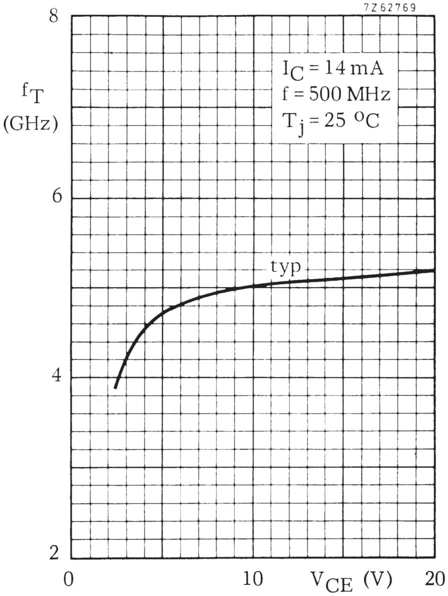
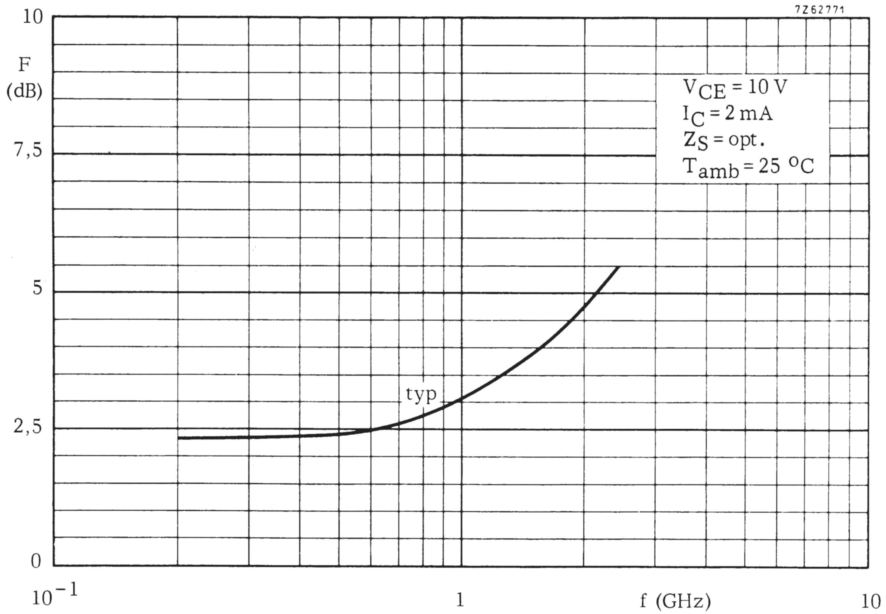


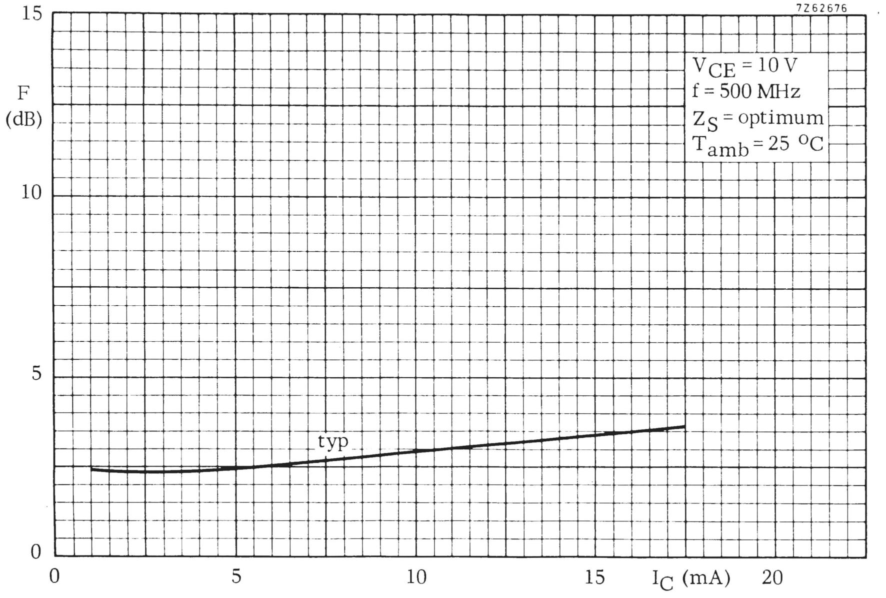
Fig. 4 V_{CE} = 10 V; T_j = 25 °C.








7Z62771
F
(dB)
10
7,5
5
2,5
0
10^{-1}
1
f (GHz)
10
$V_{CE} = 10$ V
$I_C = 2$ mA
Z_S = opt.
$T_{amb} = 25$ °C
typ


7Z62676
F
(dB)
15
10
5
0
0
5
10
15
I_C (mA)
20
$V_{CE} = 10$ V
f = 500 MHz
Z_S = optimum
$T_{amb} = 25$ °C
typ

circles of constant noise figure

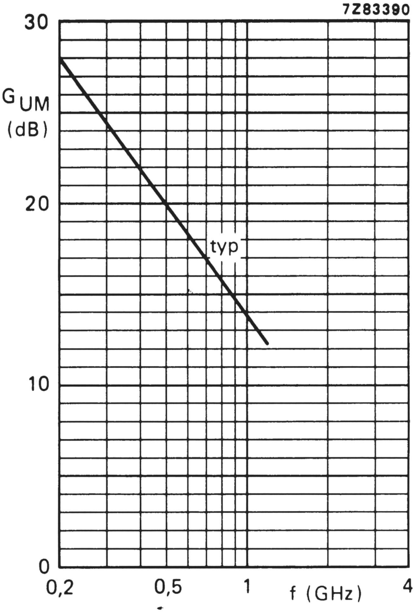
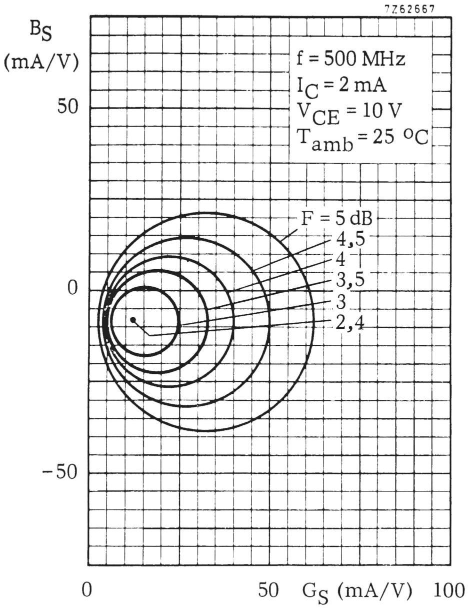


Fig. 10 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.



SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package primarily intended for use in v.h.f. and u.h.f. wideband amplifiers.

Features of this product:

- low noise;
- low intermodulation distortion;
- high power gain;
- gold metallization.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open-base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	typ.	0,35	pF
Noise figure at R_S = 60 Ω I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	F	typ.	1,8	dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	150	mV

MECHANICAL DATA

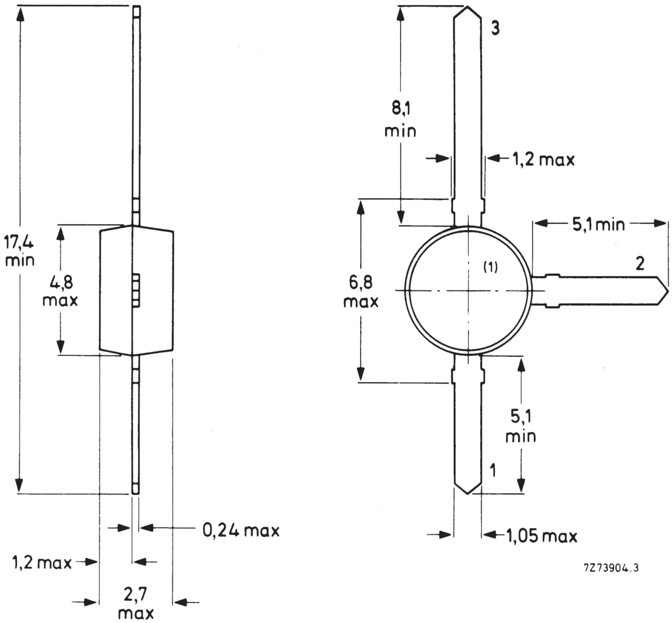
SOT-37 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections
1. Base
2. Emitter
3. Collector


17,4 min
4,8 max
0,24 max
1,2 max
2,7 max
8,1 min
1,2 max
5,1 min
6,8 max
(1)
5,1 min
1,05 max
3
2
1
7Z73904.3

(1) = type number marking.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0 V
Collector current (d.c.)	I_C	max.	25 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print (see Fig. 2) of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	500 K/W*

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* K/W is SI unit for °C/W.

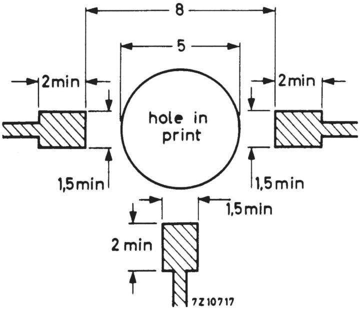


Fig. 2 Requirements for fibreglass print. (Dimensions in mm.)

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50 nA
D.C. current gain *		>	40
$I_C = 14$ mA; $V_{CE} = 10$ V	h_{FE}	typ.	90
Transition frequency at f = 500 MHz *			
$I_C = 14$ mA; $V_{CE} = 10$ V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0,6 pF
Emitter capacitance at f = 1 MHz			
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	1,2 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0$; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	C_{re}	typ.	0,35 pF
Noise figure at $T_{amb} = 25$ °C			
$I_C = 4$ mA; $V_{CE} = 10$ V; $R_S = 60\ \Omega$; f = 800 MHz	F	typ.	1,8 dB
$I_C = 4$ mA; $V_{CE} = 10$ V; $Z_S = Z_{Sopt}$; f = 2 GHz	F	typ.	3,6 dB

---

* Measured under pulse conditions.

s-parameters (common emitter)

V_{CE} V	I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
5	2	40	0,91/ −7,7°	0,01/84°	6,8/173°	1,00/ −2,7°
		200	0,79/ −37,3°	0,03/71°	6,5/143°	0,93/−12,5°
		500	0,52/ −81,0°	0,06/59°	4,6/116°	0,80/−22,5°
		800	0,34/−114,5°	0,08/58°	3,3/ 97°	0,73/−27,0°
		1000	0,26/−137,6°	0,09/59°	2,8/ 87°	0,70/−30,0°
		1200	0,22/−165,0°	0,10/61°	2,4/ 79°	0,67/−33,0°
5	5	40	0,80/ −11,7°	0,01/81°	14,4/169°	0,99/ −4,5°
		200	0,59/ −51,0°	0,03/68°	11,2/134°	0,85/−17,0°
		500	0,29/ −95,0°	0,05/66°	6,3/103°	0,70/−22,0°
		800	0,16/−130,0°	0,07/69°	4,2/ 88°	0,64/−26,0°
		1000	0,12/−162,0°	0,09/70°	3,4/ 81°	0,63/−28,0°
		1200	0,12/+ 158,0°	0,10/71°	2,9/ 74°	0,61/−31,0°
5	10	40	0,67/ −16,7°	0,01/80°	23,3/164°	0,97/ −6,6°
		200	0,39/ −63,0°	0,02/70°	14,5/122°	0,76/−18,0°
		500	0,15/−109,0°	0,05/73°	7,0/ 96°	0,64/−20,0°
		800	0,09/−152,0°	0,07/75°	4,6/ 84°	0,60/−24,0°
		1000	0,07/+ 155,0°	0,09/75°	3,7/ 77°	0,59/−26,0°
		1200	0,10/+ 124,0°	0,11/74°	3,1/ 72°	0,58/−29,0°
5	14	40	0,58/ −20,0°	0,01/79°	28,3/160°	0,96/ −7,8°
		200	0,30/ −71,0°	0,02/72°	15,5/117°	0,72/−18,0°
		500	0,11/−119,0°	0,05/75°	7,2/ 93°	0,62/−19,0°
		800	0,07/−177,0°	0,07/77°	4,6/ 82°	0,59/−23,0°
		1000	0,08/+ 138,0°	0,09/76°	3,8/ 76°	0,58/−25,0°
		1200	0,12/+ 118,0°	0,11/76°	3,2/ 71°	0,57/−28,0°
5	20	40	0,49/ −25,0°	0,01/78°	32,9/157°	0,94/ −9,0°
		200	0,22/ −82,0°	0,02/74°	15,9/112°	0,69/−17,0°
		500	0,09/−143,0°	0,05/78°	7,1/ 91°	0,61/−18,0°
		800	0,08/+ 160,0°	0,07/78°	4,5/ 80°	0,59/−22,0°
		1000	0,10/+ 130,0°	0,09/78°	3,7/ 75°	0,58/−24,0°
		1200	0,14/+ 115,0°	0,11/77°	3,1/ 69°	0,57/−28,0°
5	30	40	0,36/ −38,9°	0,01/76°	31,2/151°	0,90/−10,3°
		200	0,18/−122,0°	0,02/75°	14,0/106°	0,66/−14,0°
		500	0,15/−175,0°	0,05/80°	6,1/ 88°	0,61/−16,0°
		800	0,17/+ 148,0°	0,07/80°	3,9/ 78°	0,59/−21,0°
		1000	0,19/+ 131,0°	0,09/79°	3,1/ 72°	0,59/−24,0°
		1200	0,23/+ 119,0°	0,11/79°	2,7/ 67°	0,57/−28,0°

s-parameters (common emitter)

V_{CE} V	I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
10	2	40	0,91/ −7,5°	0,01/84°	7,0/173°	1,00/ −2,6°
		200	0,81/ −36,0°	0,03/72°	6,3/149°	0,94/−12,0°
		500	0,54/ −78,0°	0,06/59°	4,6/118°	0,82/−21,0°
		800	0,35/−110,0°	0,08/58°	3,4/ 98°	0,74/−26,0°
		1000	0,27/−132,0°	0,08/59°	2,8/ 89°	0,72/−29,0°
		1200	0,22/−159,0°	0,09/61°	2,5/ 80°	0,69/−0,32°
10	5	40	0,81/ −11,1°	0,01/82°	14,4/169°	0,99/ −4,3°
		200	0,61/ −48,0°	0,03/69°	11,1/135°	0,86/−16,0°
		500	0,31/ −90,0°	0,05/66°	6,4/105°	0,71/−22,0°
		800	0,17/−120,0°	0,07/69°	4,3/ 90°	0,66/−25,0°
		1000	0,11/−148,0°	0,08/70°	3,5/ 82°	0,64/−27,0°
		1200	0,10/+ 167,0°	0,10/71°	3,0/ 76°	0,63/−30,0°
10	10	40	0,70/ −15,2°	0,01/80°	23,0/164°	0,97/ −6,1°
		200	0,42/ −58,0°	0,02/70°	14,8/124°	0,78/−17,0°
		500	0,17/ −95,0°	0,05/73°	7,3/ 97°	0,65/−20,0°
		800	0,07/−104,0°	0,07/75°	4,7/ 85°	0,62/−23,0°
		1000	0,04/−174,0°	0,09/75°	3,9/ 79°	0,61/−25,0°
		1200	0,07 + 120,0°	0,10/75°	3,3/ 73°	0,59/−28,0°
10	14	40	0,63/ −18,0°	0,01/79°	28,2/161°	0,96/ −7,2°
		200	0,34/ −63,0°	0,02/72°	15,9/119°	0,74/−17,0°
		500	0,13/ −98,0°	0,05/75°	7,5/ 95°	0,63/−19,0°
		800	0,05/−136,0°	0,07/77°	4,8/ 83°	0,61/−22,0°
		1000	0,04/+ 133,0°	0,09/76°	3,9/ 77°	0,60/−25,0°
		1200	0,08/+ 108,0°	0,10/76°	3,3/ 72°	0,58/−28,0°

Output voltage at d_{im} = −60 dB (see Figs 3 and 15)
(DIN 45004B, par. 6.3: 3-tone)
I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR $<$ 2; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz
Measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 150 mV

Second harmonic distortion (see Figs 3 and 16)
I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR $<$ 2; T_{amb} = 25 °C
V_p = 60 mV at f_p = 250 MHz
V_q = 60 mV at f_q = 560 MHz
measured at $f_{(p+q)}$ = 810 MHz — d_2 typ. −50 dB

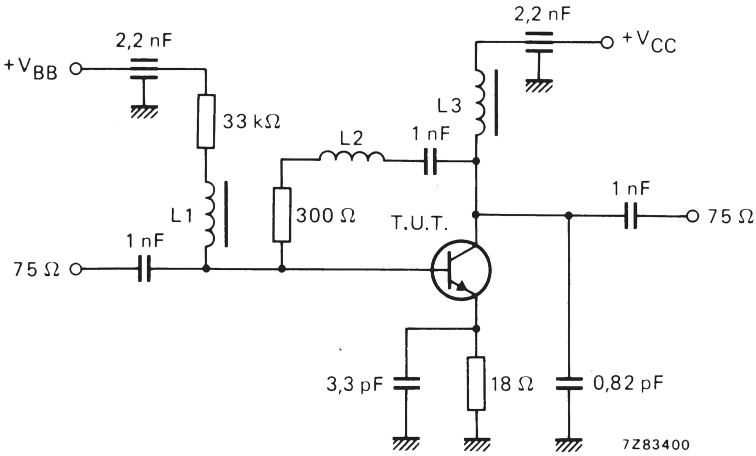

2,2 nF
+V_CC
2,2 nF
+V_BB
L3
33 kΩ
L2
1 nF
1 nF
L1
300 Ω
T.U.T.
75 Ω
1 nF
75 Ω
3,3 pF
18 Ω
0,82 pF
7Z83400

Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro choke
L2 = 3 turns Cu wire (0,4 mm); internal diameter 3 mm; winding pitch 1 mm

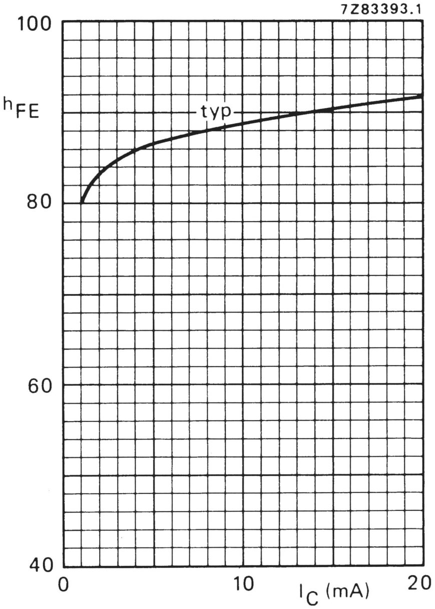


Fig. 4 V_{CE} = 10 V; T_j = 25 °C.

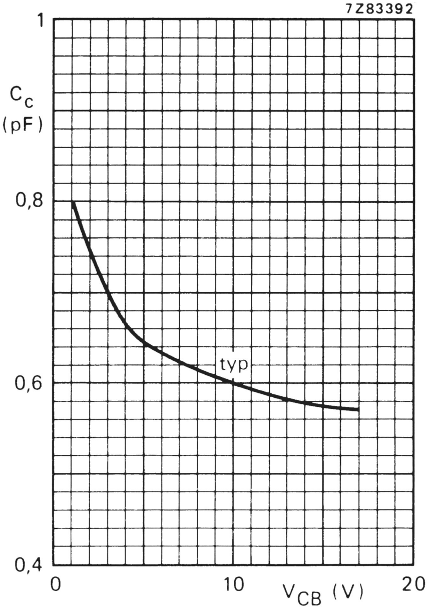


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

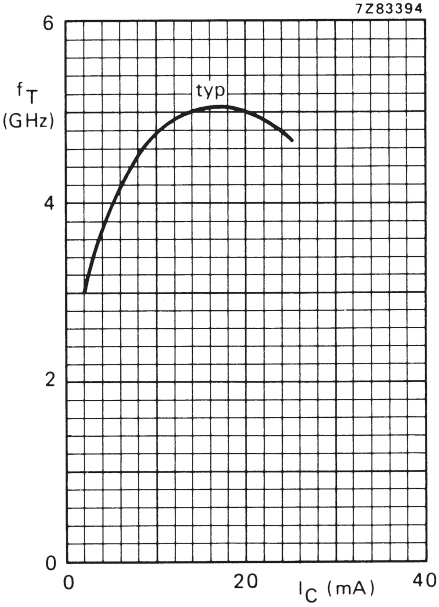


Fig. 6 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

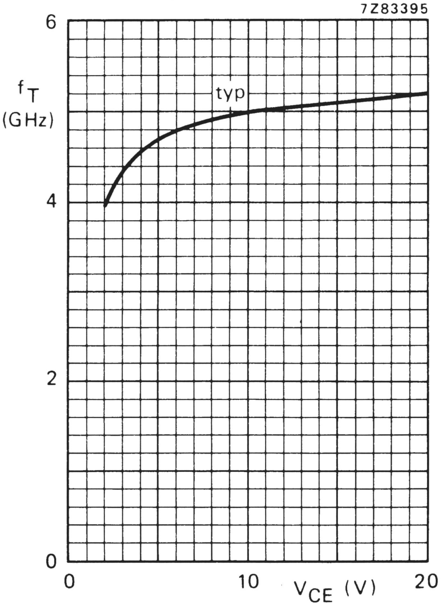


Fig. 7 I_C = 14 mA; f = 500 MHz; T_j = 25 °C.

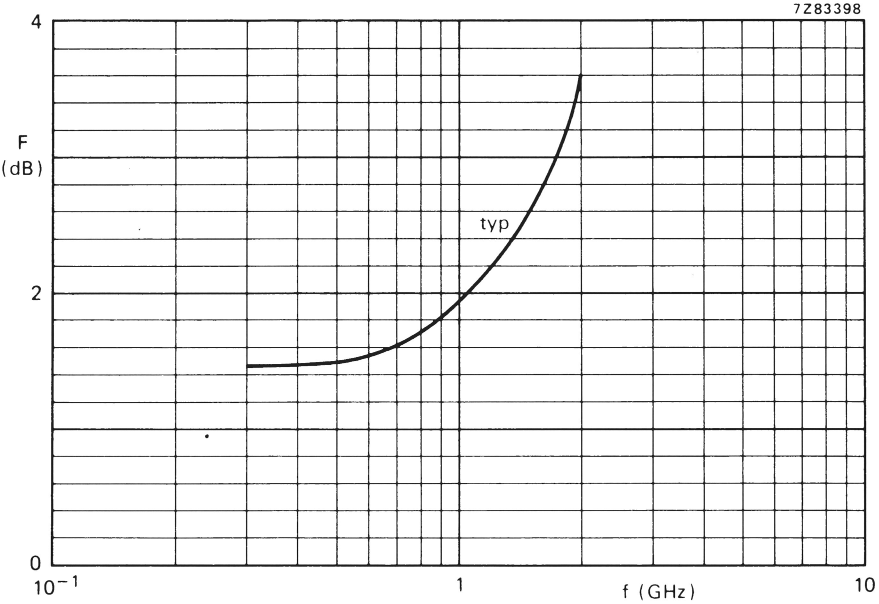


Fig. 8 V_{CE} = 10 V; I_C = 4 mA; Z_S = optimum; T_{amb} = 25 °C.

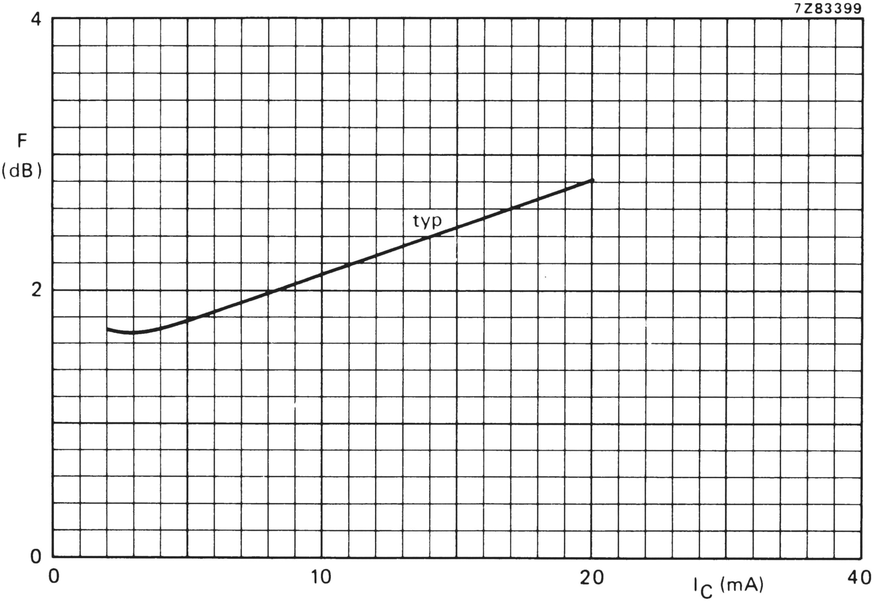


Fig. 9 V_{CE} = 10 V; f = 800 MHz; Z_S = optimum; T_{amb} = 25 °C.

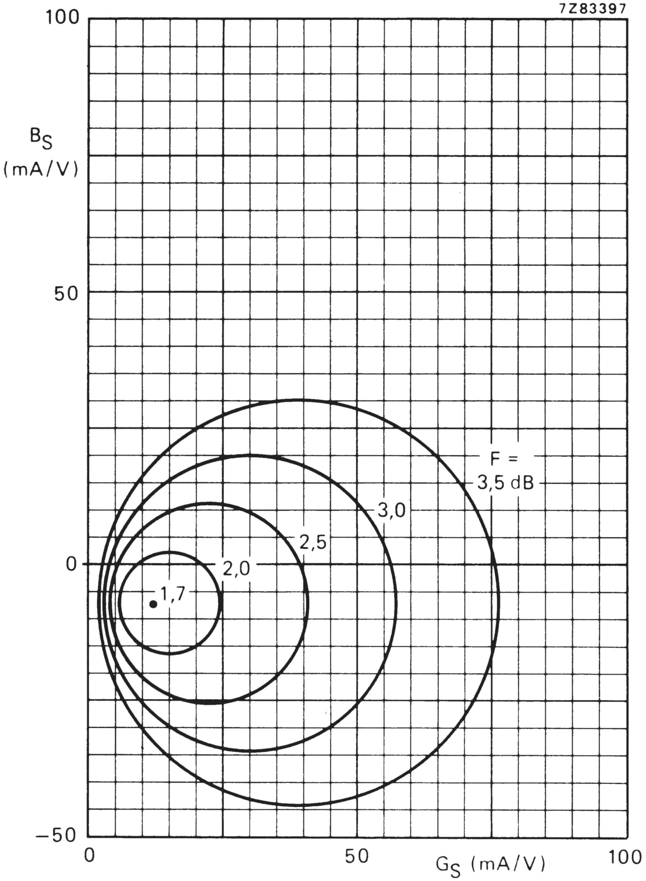


Fig. 10 Circles of constant noise figure.
V_{CE} = 10 V; I_C = 4 mA; f = 800 MHz; T_{amb} = 25 °C; typical values.

Conditions for Figs 11 and 12:
$V_{CE} = 10$ V; $I_C = 14$ mA;
$T_{amb} = 25$ °C.

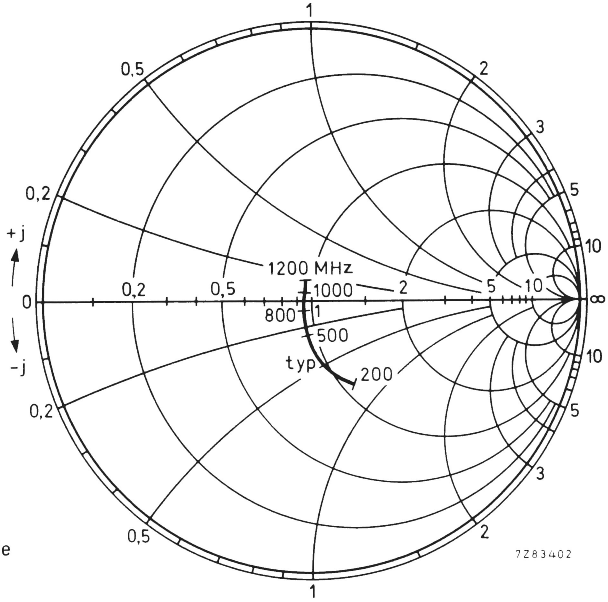


Fig. 11 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

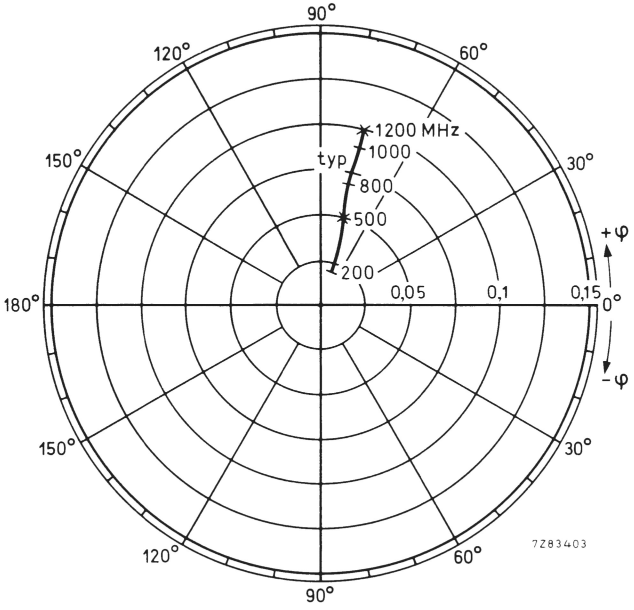


Fig. 12 Reverse transmission coefficient s_{re}.

Conditions for Figs 13 and 14:
V_{CE} = 10 V; I_C = 14 mA;
T_{amb} = 25 °C.

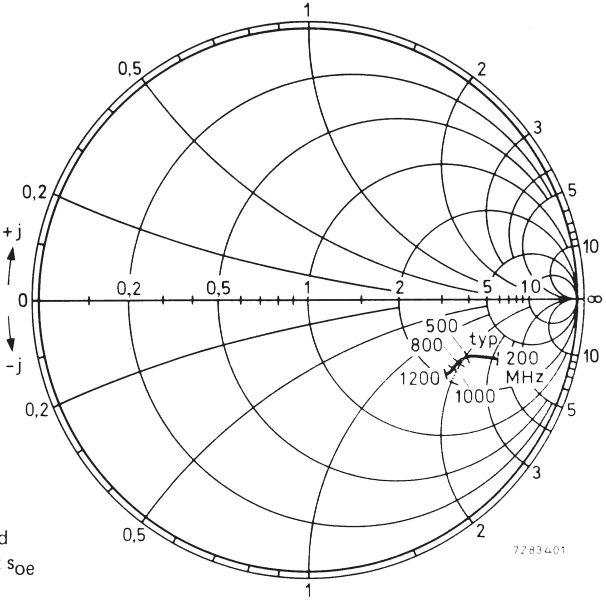


Fig. 13 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

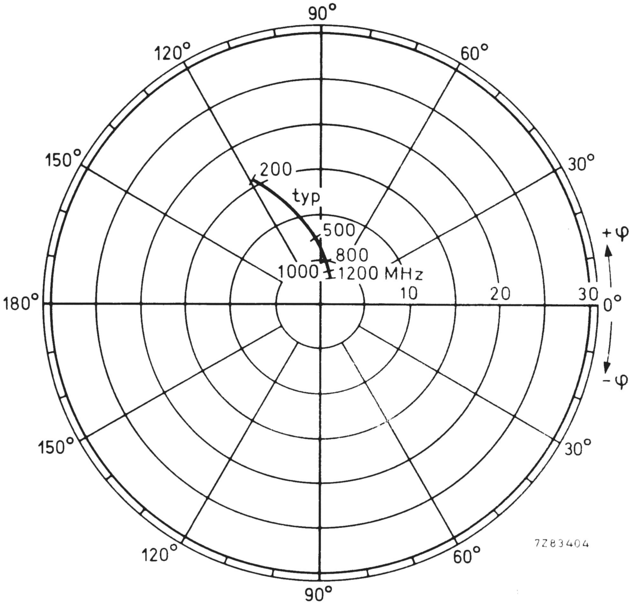


Fig. 14 Forward transmission coefficient s_{fe}.

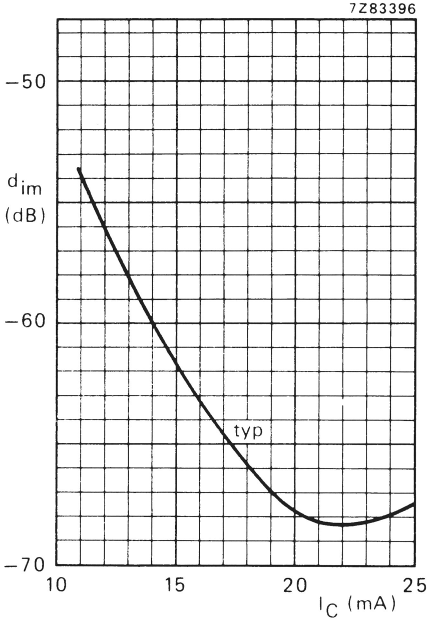


Fig. 15.

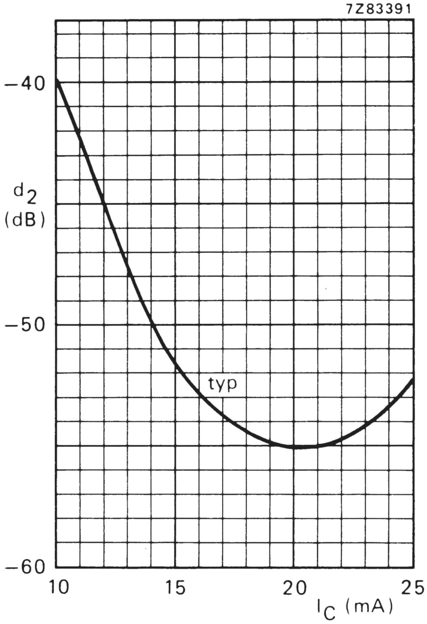


Fig. 16.

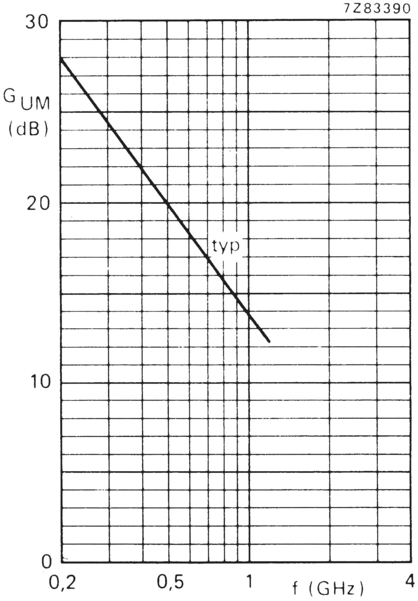


Fig. 17 V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 ^oC.

Fig. 15 V_{CE} = 10 V; V_o = 43,5 dBmV = 150 mV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 ^oC; measured in MATV test circuit (see Fig. 3).

Fig. 16 V_{CE} = 10 V; V_o = 60 mV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 ^oC; measured in MATV test circuit (see Fig. 3).

THE BFR91A IS RECOMMENDED
FOR NEW DESIGN

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.
The transistor features very low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
Max. unilateral power gain (see page 3) I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	18	dB
Intermodulation distortion at T_{amb} = 25 °C I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; V_o = 300 mV $f_{(p+q-r)}$ = 493,25 MHz (see page 4)	d_{im}	typ.	−60	dB

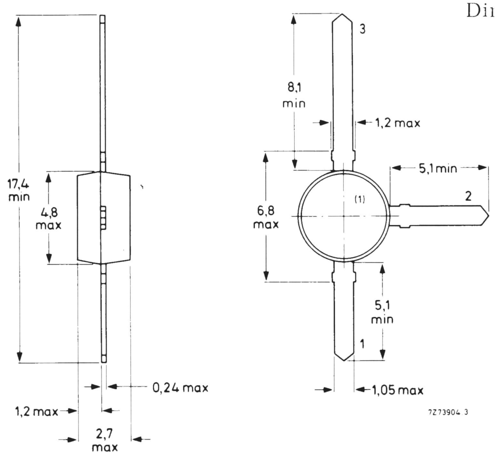
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages				
Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Current				
Collector current (d.c.)	I_C	max.	35	mA
Power dissipation				
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Temperatures				
Storage temperature	T_{stg}	-65 to +150		°C
Junction temperature	T_j	max.	150	°C

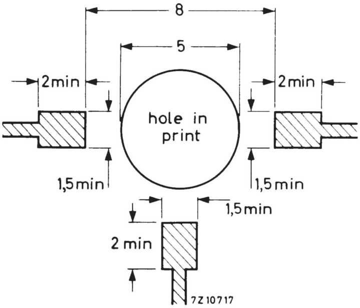
THERMAL RESISTANCE

From junction to ambient in free air

mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm — $R_{th\ j-a}$ = 0,5 °C/mW

*) Requirements for glass-fibre print

(dimensions in mm)



CHARACTERISTICS $T_j = 25\ ^{o}C$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	<	50	nA
D.C. current gain [1]				
$I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	> typ.	40 90	
Transition frequency at f = 500 MHz [1]				
$I_C = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0,7	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0{,}5$ V	C_e	typ.	2,5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 0$; $V_{CE} = 5$ V; $T_{amb} = 25\ ^{o}C$	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance				
$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25\ ^{o}C$	F	typ.	1,9	dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25\ ^{o}C$	G_{UM}	typ.	18	dB

---

[1] Measured under pulse conditions.

CHARACTERISTICS (continued)

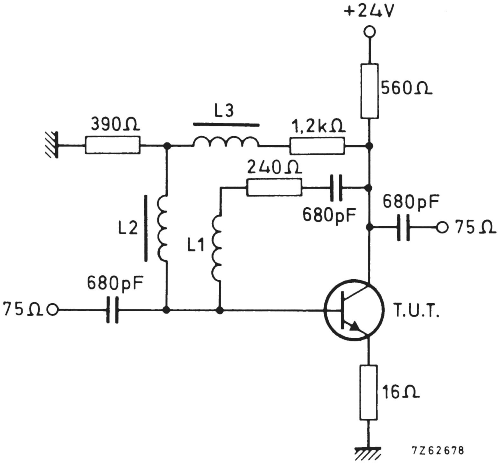
Intermodulation distortion at T_{amb} = 25 °C

I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; V.S.W.R. < 2

$V_p = V_o$ = 300 mV at f_p = 495,25 MHz
$V_q = V_o$ −6 dB at f_q = 503,25 MHz
$V_r = V_o$ −6 dB at f_r = 505,25 MHz

Measured at $f_{(p+q-r)}$ = 493,25 MHz	d_{im}	typ.	−60	dB

Intermodulation test circuit:


+24V
560Ω
L3
390Ω
1,2kΩ
240Ω
680pF
680pF
75Ω
L2
L1
680pF
75Ω
T.U.T.
16Ω
7Z62678

L1 = 4 turns Cu wire (0,35); winding pitch 1 mm; int. diam. 4 mm
L2 and L3 5 μH (code number: 3122 108 20150)

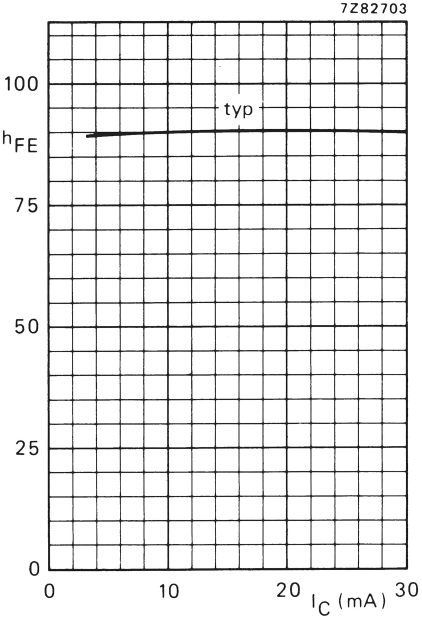
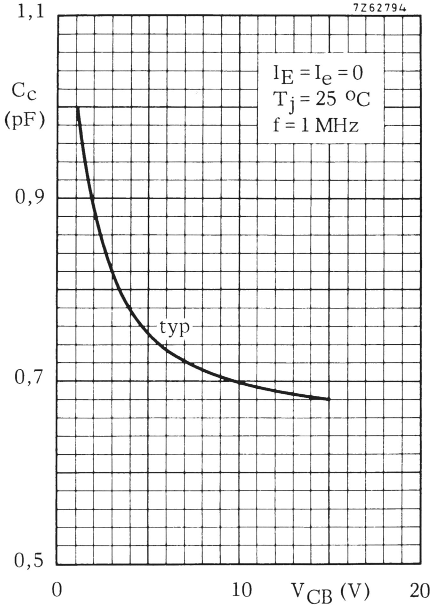
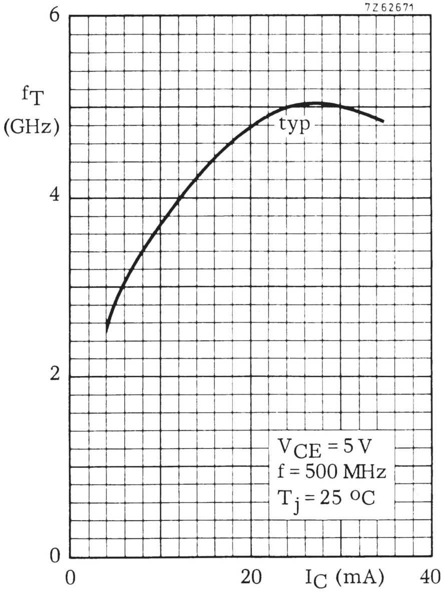
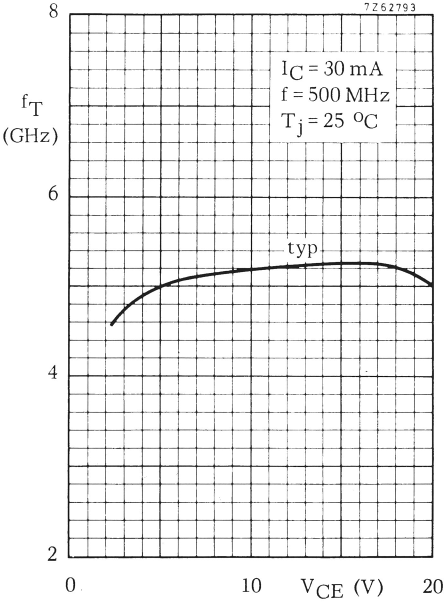
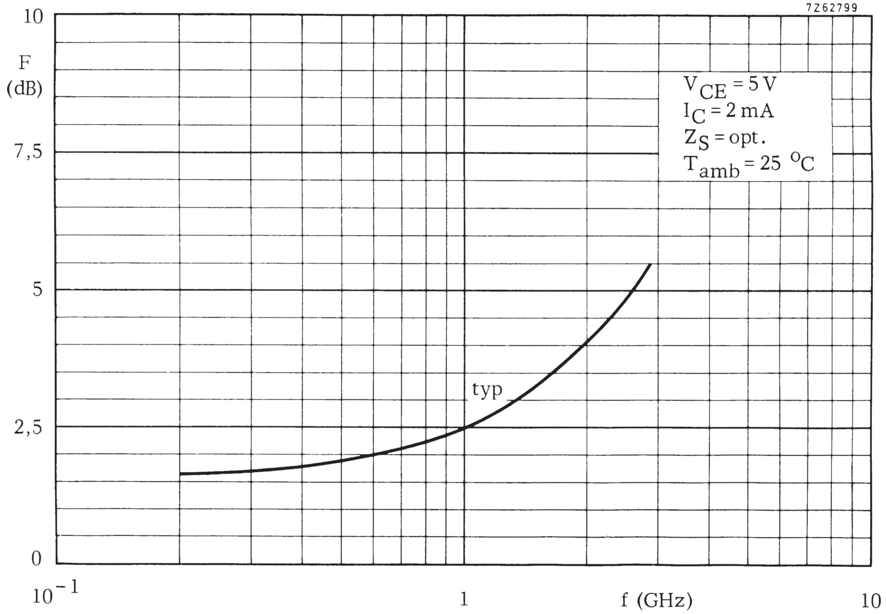


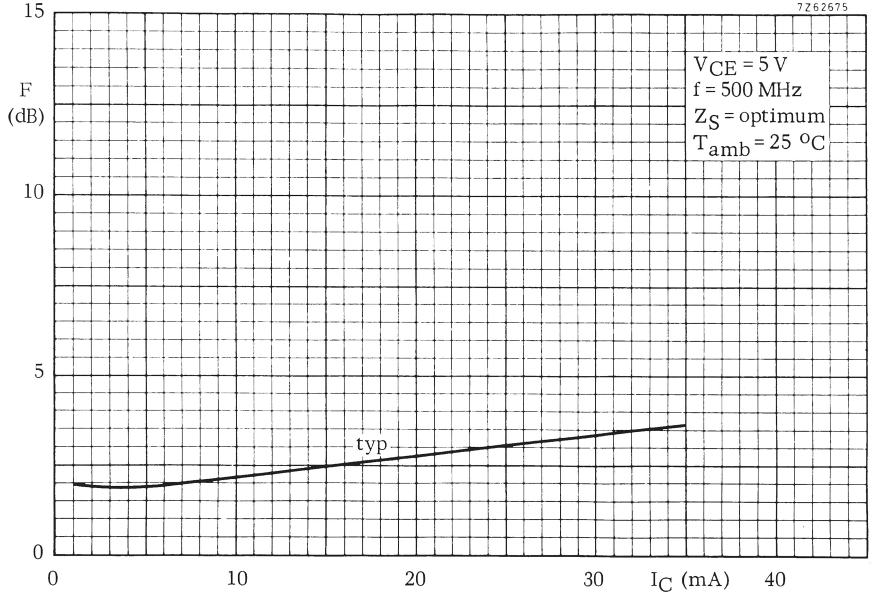
Fig. 4 $V_{CE} = 5$ V; $T_j = 25$ °C.








7Z62799
F
(dB)
10
7,5
5
2,5
0
V_{CE} = 5 V
I_C = 2 mA
Z_S = opt.
T_{amb} = 25 °C
typ
10^{-1}
1
f (GHz)
10


7Z62675
F
(dB)
15
10
5
0
V_{CE} = 5 V
f = 500 MHz
Z_S = optimum
T_{amb} = 25 °C
typ
0
10
20
30
I_C (mA)
40

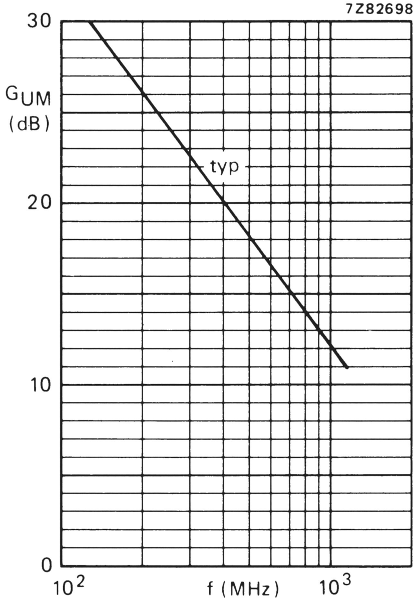
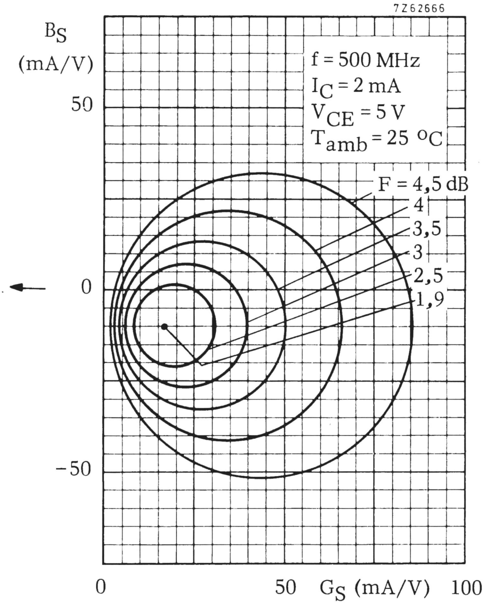


Fig. 10 V_{CE} = 5 V; I_C = 30 mA;
T_{amb} = 25 °C.

circles of constant noise figure



SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package primarily intended for use in u.h.f. and microwave amplifiers.

Features of this product:

- low noise;
- very low intermodulation distortion;
- high power gain;
- gold metallization.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	6	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,6	pF
Noise figure at optimum source impedance I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz	F	typ.	1,6	dB
Maximum unilateral power gain I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	14	dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	425	mV

MECHANICAL DATA

SOT-37 (see Fig. 1).

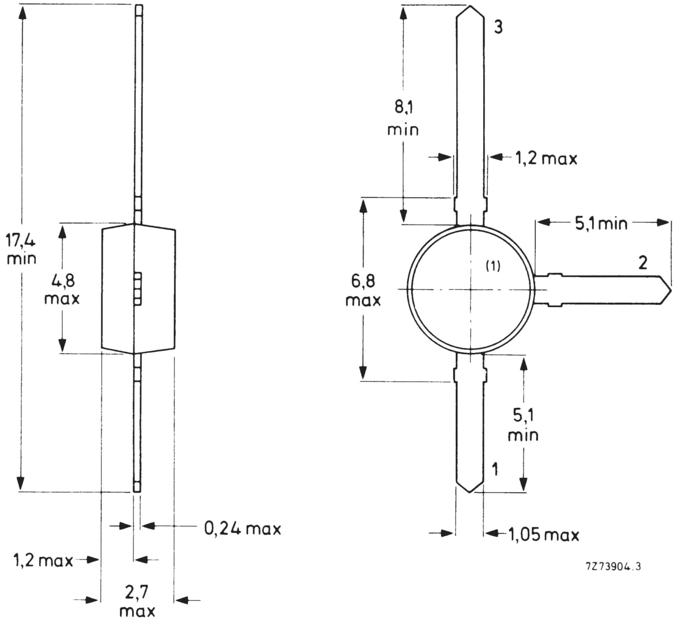
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector


17,4 min
4,8 max
1,2 max
0,24 max
2,7 max
3
8,1 min
1,2 max
5,1 min
2
(1)
6,8 max
5,1 min
1
1,05 max
7Z73904.3

(1) = type number marking.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,0	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print (see Fig. 2) of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	300 K/W *

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* K/W is SI unit for °C/W.

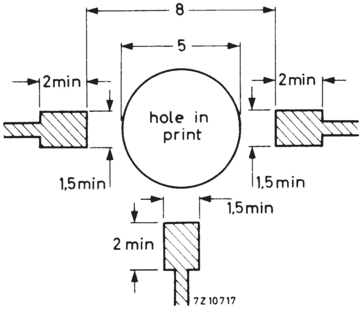

Fig. 2 Requirements for fibre-glass print. (Dimensions in mm.)

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	$<$	50	nA
D.C. current gain*				
$I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	$>$ typ.	40 90	
Transition frequency at f = 500 MHz*				
$I_C = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	6	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0,9	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	2,5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	C_{re}	typ.	0,6	pF
Noise figure at optimum source impedance				
$I_C = 4$ mA; $V_{CE} = 8$ V; f = 800 MHz	F	typ.	1,6	dB
$I_C = 30$ mA; $V_{CE} = 8$ V; f = 800 MHz	F	typ.	2,3	dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)\,(1-|s_{oe}|^2)}$$

$I_C = 30$ mA; $V_{CE} = 8$ V; f = 800 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	14	dB

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* Measured under pulse conditions.

Output voltage at d_{im} = −60 dB (see Figs 3 and 14)
(DIN 45004B, par. 6.3: 3-tone)
I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = −60 dB; f_p = 795,25 MHz
$V_q = V_o$ −6 dB ; f_q = 803,25 MHz
$V_r = V_o$ −6 dB ; f_r = 805,25 MHz
Measured at $f_{(p+q-r)}$ = 793,25 MHz V_o typ. 425 mV

Output voltage at d_2 = −50 dB (see Figs 3 and 15)
I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_2 = −50 dB; f_p = 250 MHz
$V_q = V_o$ at d_2 = −50 dB; f_q = 560 MHz
measured at $f_{(p+q)}$ = 810 MHz V_o typ. 200 mV

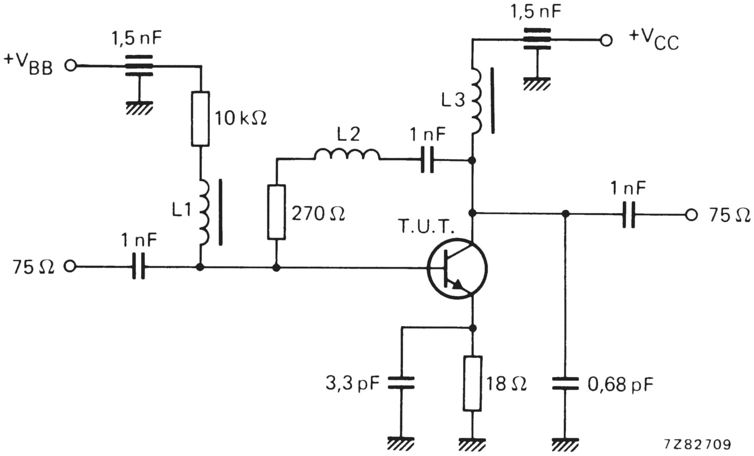

1,5 nF
+V$_{CC}$
1,5 nF
+V$_{BB}$
L3
10 kΩ
L2
1 nF
1 nF
270 Ω
L1
75 Ω
T.U.T.
1 nF
75 Ω
3,3 pF
18 Ω
0,68 pF
7Z82709

Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro choke
L2 = 3 turns Cu wire (0,4 mm); internal diameter 3 mm; winding pitch 1 mm

s-parameters (common emitter) at V_{CE} = 8 V.

The figures given in the tables below can also be used for operation at V_{CE} = 5 V. Only slight differences for the s-parameters may occur.

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
2	40	0,89/−12,9°	0,01/75°	9,5/166°	0,97/−6,1°
	100	0,85/−30,7°	0,03/70,6°	8,7/155°	0,94/−13,5°
	200	0,75/−57,1°	0,05/61,5°	7,4/138°	0,87/−22,5°
	500	0,48/−113°	0,08/50,9°	4,4/106°	0,72/−34,2°
	800	0,37/−153°	0,09/51,9°	3,0/86,3°	0,64/−40,0°
	1000	0,34/−178°	0,10/55,0°	2,6/77,0°	0,61/−47,8°
	1200	0,34/+159°	0,11/58,5°	2,2/68,0°	0,58/−53,9°
5	40	0,79/−18,4°	0,01/74°	17,8/162°	0,94/−9,1°
	100	0,71/−42,1°	0,03/67,1°	15,2/146°	0,87/−19,5°
	200	0,57/−72,8°	0,04/60,0°	11,5/126°	0,75/−28,7°
	500	0,31/−127°	0,07/60,1°	5,8/98,2°	0,59/−36,1°
	800	0,25/−168°	0,09/63,6°	3,8/82,0°	0,54/−41,0°
	1000	0,25/+165°	0,11/65,2°	3,2/74,4°	0,51/−46,7°
	1200	0,26/+141°	0,13/66,1°	2,7/66,7°	0,49/−52,2°
10	40	0,67/−25,3°	0,01/71°	27,9/156°	0,90/−12,8°
	100	0,55/−55,1°	0,02/65,1°	21,8/136°	0,78/−25,6°
	200	0,40/−88,2°	0,04/62,4°	14,7/116°	0,62/−33,4°
	500	0,20/−141°	0,06/68,3°	6,7/93,0°	0,51/−35,9°
	800	0,16/+177°	0,09/70,0°	4,3/79,3°	0,48/−40,3°
	1000	0,18/+151°	0,12/69,7°	3,5/72,5°	0,46/−44,2°
	1200	0,21/+130°	0,14/68,9°	3,0/65,1°	0,43/−50,7°
20	40	0,51/−34,7°	0,01/69°	39,7/149°	0,84/−17,4°
	100	0,38/−70,5°	0,02/65,8°	27,7/126°	0,66/−29,5°
	200	0,26/−104°	0,03/68,0°	16,8/109°	0,51/−32,5°
	500	0,16/−158°	0,06/74,0°	7,3/89,3°	0,45/−33,4°
	800	0,14/+155°	0,10/73,6°	4,6/77,5°	0,42/−39,1°
	1000	0,17/+133°	0,12/72,3°	3,8/71,2°	0,41/−43,6°
	1200	0,21/+115°	0,14/70,5°	3,2/64,4°	0,39/−51,0°
30	40	0,46/−36,5°	0,01/73°	43,3/150°	0,87/−16,9°
	100	0,32/−73,7°	0,02/69,2°	29,1/124°	0,66/−27,2°
	200	0,20/−109°	0,03/72,0°	17,1/106°	0,50/−28,1°
	500	0,14/−174°	0,06/75,6°	7,4/87,2°	0,41/−31,7°
	800	0,15/+143°	0,10/74,7°	4,8/74,9°	0,39/−41,0°
	1000	0,17/+124°	0,12/72,9°	3,9/70,5°	0,38/−42,8°
	1200	0,21/+111°	0,15/71,0°	3,3/63,8°	0,37/−51,0°

Conditions for Figs 4 and 5:
V_{CE} = 8 V; I_C = 30 mA;
T_{amb} = 25 °C.

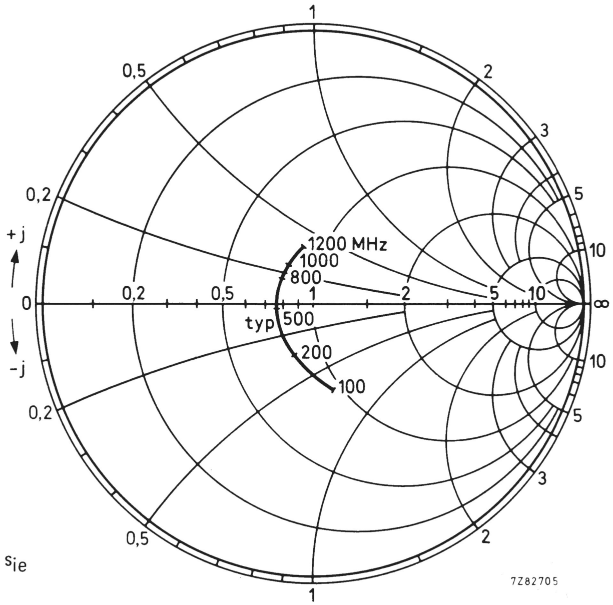


Fig. 4 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

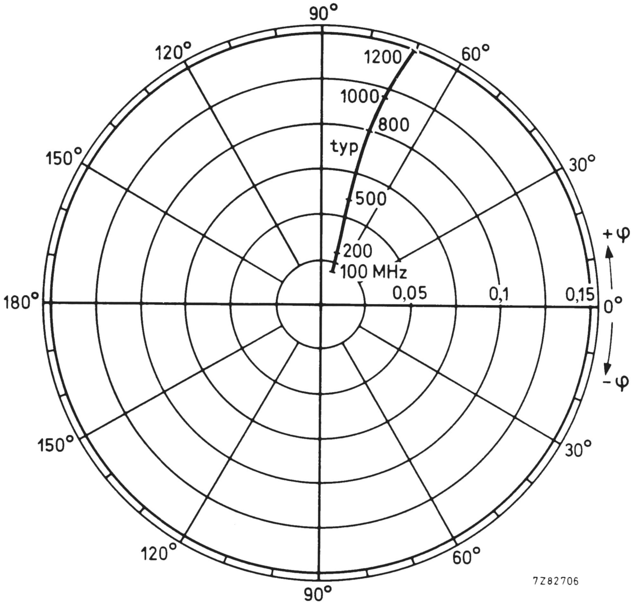


Fig. 5 Reverse transmission coefficient s_{re}.

Conditions for Figs 6 and 7:
$V_{CE} = 8$ V; $I_C = 30$ mA;
$T_{amb} = 25$ °C.

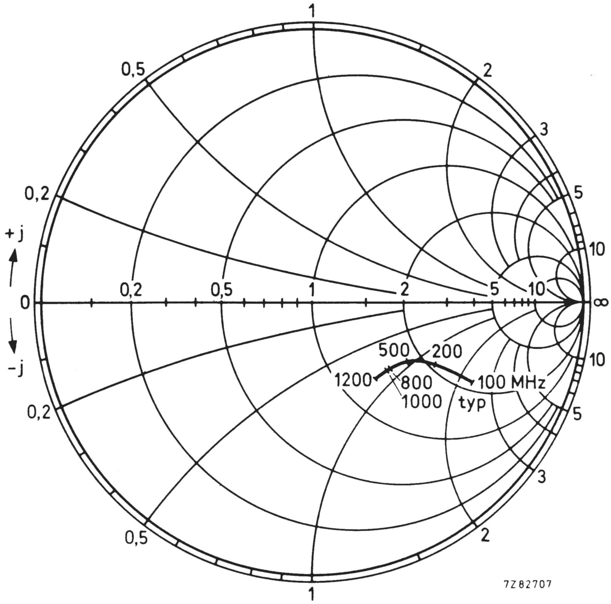


Fig. 6 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

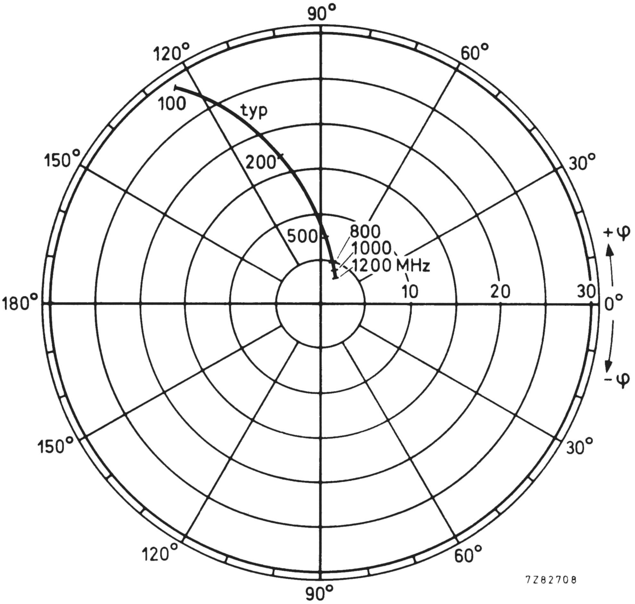


Fig. 7 Forward transmission coefficient s_{fe}.

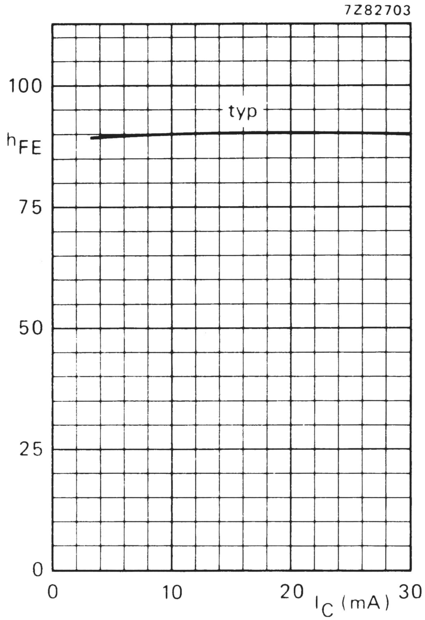


Fig. 8 V_{CE} = 5 V; T_j = 25 °C.

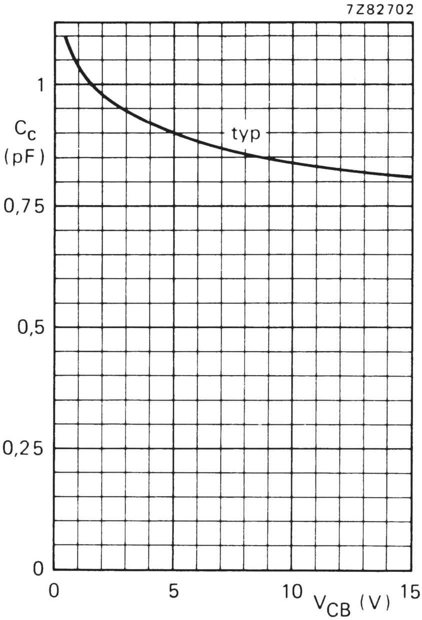


Fig. 9 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

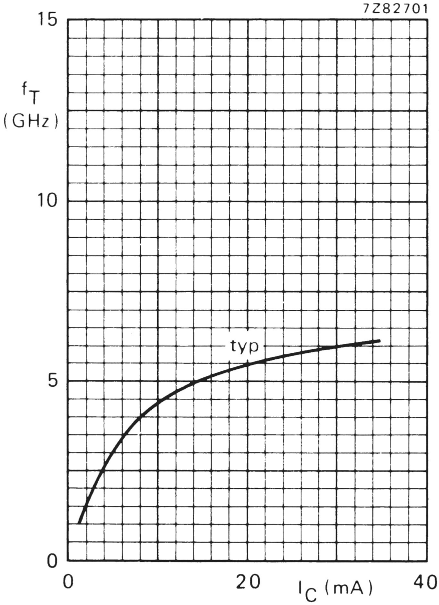


Fig. 10 V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

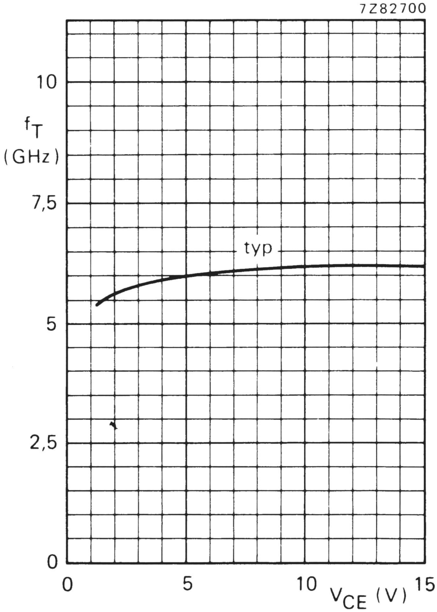


Fig. 11 I_C = 30 mA; f = 500 MHz; T_j = 25 °C.

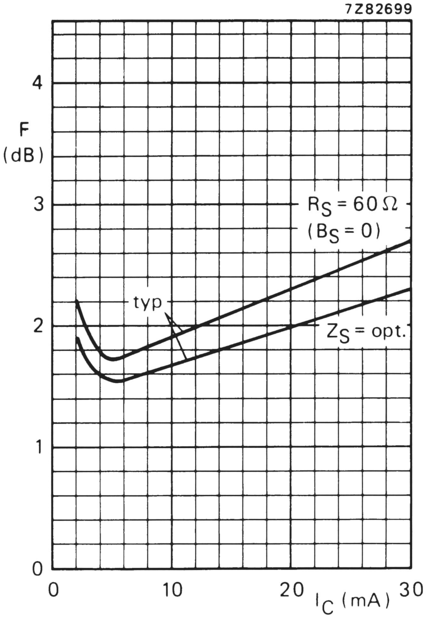


Fig. 12 V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C.

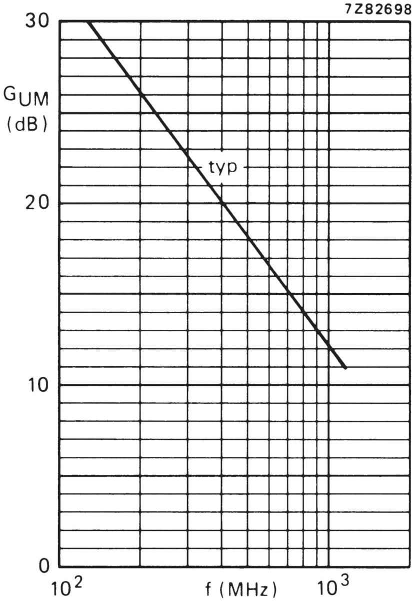


Fig. 13 V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

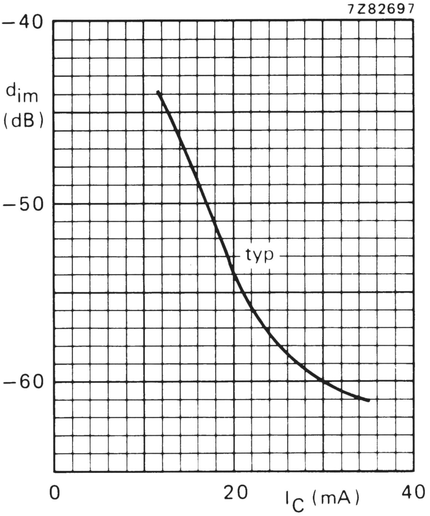


Fig. 14 V_{CE} = 8 V; V_o = 425 mV = 52,6 dBmV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C; measured in MATV test circuit (see Fig. 3).

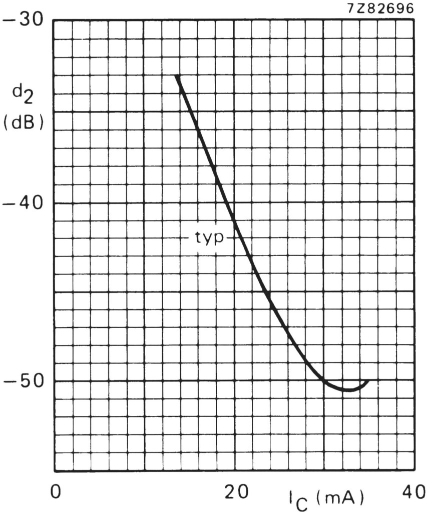


Fig. 15 V_{CE} = 8 V; V_o = 200 mV = 46 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C; measured in MATV test circuit (see Fig. 3).

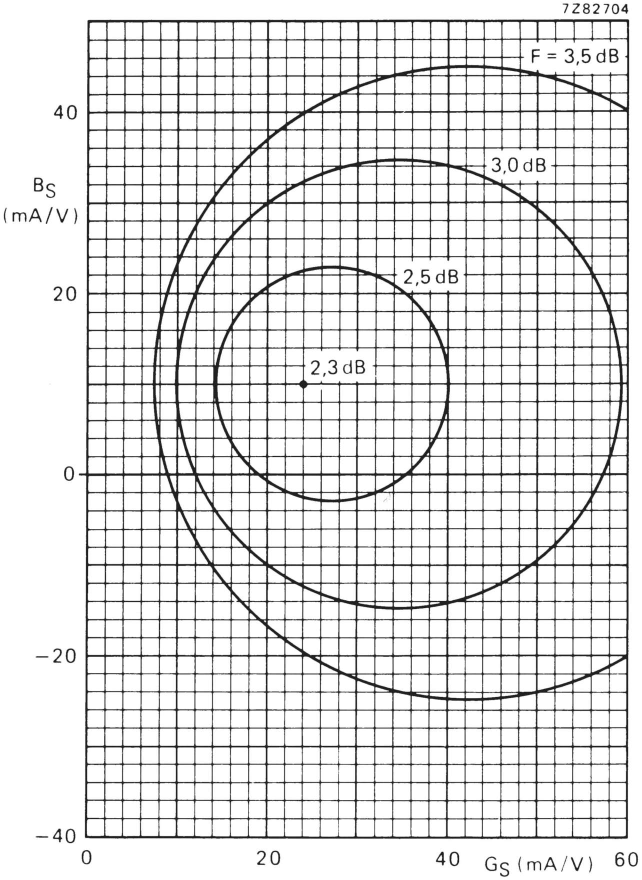


Fig. 16 Circles of constant noise figure.
V_{CE} = 8 V; I_C = 30 mA; f = 800 MHz;
T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N resistance-stabilized transistor in a SOT-48 capstan envelope featuring extremely low cross modulation, intermodulation and second harmonic distortion. Thanks to its high transition frequency it has a high power gain in conjunction with good wideband properties and low noise up to high frequencies.

It is primarily intended for CATV and MATV applications.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_h = 145 °C; f > 1 MHz	P_{tot}	max.	3,5	W
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 90 mA; V_{CE} = 20 V	f_T	typ.	3,5	GHz
Cross modulation distortion (channel 13) I_C = 90 mA; V_{CE} = 20 V; V_o = 48 dBmV	d_{cm}	typ. <	−61 −57	dB dB
I_C = 90 mA; V_{CE} = 20 V; V_o = 32 dBmV	d_{cm}	typ. <	−93 −89	dB dB
Intermodulation distortion at $f_{(p+q-r)}$ = 194,25 MHz I_C = 90 mA; V_{CE} = 20 V; V_o = 60 dBmV	d_{im}	typ.	−63	dB
Broadband power gain I_C = 90 mA; V_{CE} = 20 V	G_p	> typ.	10 11	dB dB
Noise figure at f = 200 MHz I_C = 90 mA; V_{CE} = 20 V	F	typ. <	8 10	dB dB
2nd harmonic distortion at $f_p + f_q$ = 210 MHz I_C = 90 mA; V_{CE} = 20 V; V_o = 48 dBmV	d_2	<	−56	dB

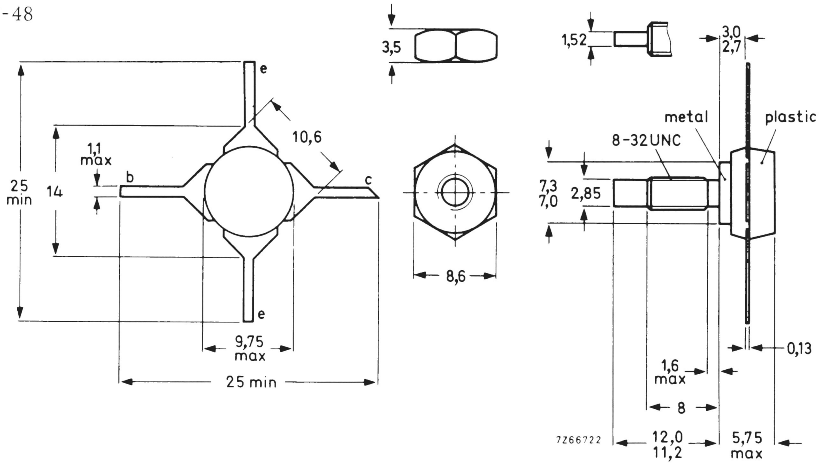
MECHANICAL DATA (see page 2)

CAUTION. These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that the BeO disc is not damaged. ←

MECHANICAL DATA

Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (R_{BE} = 10 Ω)	V_{CER}	max.	35	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V

Currents

Collector current (d.c.)	I_C	max.	150	mA
Collector current (peak value): f > 1 MHz	I_{CM}	max.	300	mA

Power dissipation

Total power dissipation (d.c.) up to T_h = 160 °C	P_{tot}	max.	2,5	W
Total power dissipation up to T_h = 145 °C; f > 1 MHz	P_{tot}	max.	3,5	W

Temperatures

Storage temperature	T_{stg}	-65 to	+200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	15	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	°C/W

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current					
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	50	µA	
D.C. current gain					
$I_C = 50$ mA; $V_{CE} = 20$ V	h_{FE}	>	30		1)
$I_C = 150$ mA; $V_{CE} = 20$ V	h_{FE}	>	30		1)
Transition frequency at f = 500 MHz					
$I_C = 90$ mA; $V_{CE} = 20$ V	f_T	typ.	3,5	GHz	1)
$I_C = 150$ mA; $V_{CE} = 20$ V	f_T	typ.	3,5	GHz	1)
Collector capacitance at f = 1 MHz					
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	typ.	3,5	pF	
Emitter capacitance at f = 1 MHz					
$I_C = I_c = 0$; $V_{EB} = 0,5$ V	C_e	typ.	12	pF	
Feedback capacitance at f = 1 MHz					
$I_C = 10$ mA; $V_{CE} = 20$ V	C_{re}	typ.	1,3	pF	
Collector-stud capacitance at f = 1 MHz	C_{cs}	typ.	2	pF	
Noise figure at optimum source impedance					
$I_C = 90$ mA; $V_{CE} = 20$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	5	dB	1)
Max. unilateral power gain (s_{re} assumed to be zero)					
G_{UM} (in dB) $= 10 \log \frac{\lvert s_{fe}\rvert^2}{(1 - \lvert s_{ie}\rvert^2)(1 - \lvert s_{oe}\rvert^2)}$					
$I_C = 90$ mA; $V_{CE} = 20$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	13,5	dB	

---

1) Measured under pulse conditions.

CHARACTERISTICS (continued)

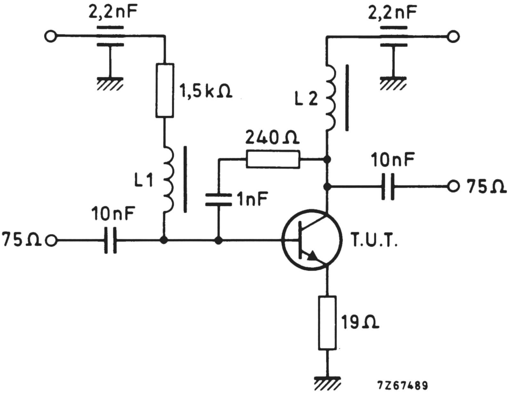
Intermodulation distortion at T_{amb} = 25 °C

I_C = 90 mA; V_{CE} = 20 V; R_L = 75 Ω

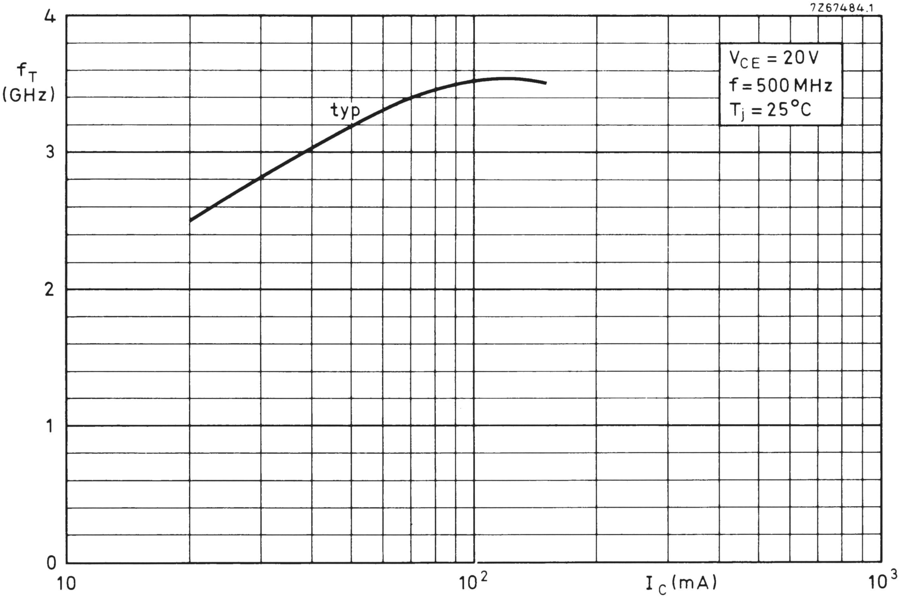
$V_p = V_o$ = 700 mV at f_p = 495, 25 MHz
$V_q = V_o$ −6 dB at f_q = 503, 25 MHz
$V_r = V_o$ −6 dB at f_r = 505, 25 MHz

Measured at $f_{(p+q-r)}$ = 493, 25 MHz	d_{im}	typ.	−60	dB

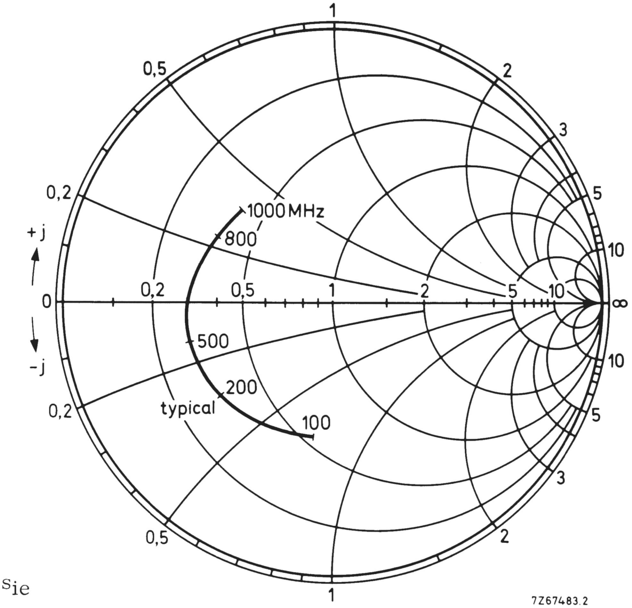
MATV test circuit


2,2nF
2,2nF
1,5kΩ
L2
240Ω
10nF
L1
1nF
75Ω
10nF
75Ω
T.U.T.
19Ω
7Z67489

L1 = L2 = 5 μH ferroxcube coil (code number: 3122 108 20153)

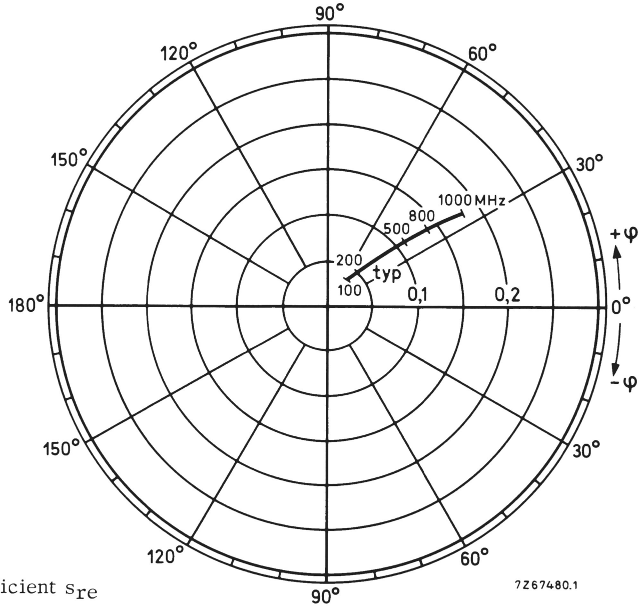

7Z67484.1
f_T (GHz)
4
3
2
1
0
10
10^2
I_C (mA)
10^3
typ
V_{CE} = 20 V
f = 500 MHz
T_j = 25 °C

V_{CE} = 20 V
I_C = 90 mA
T_{amb} = 25 °C



Input reflection coefficient s_{ie}

V_{CE} = 20 V
I_C = 90 mA
T_{amb} = 25 °C

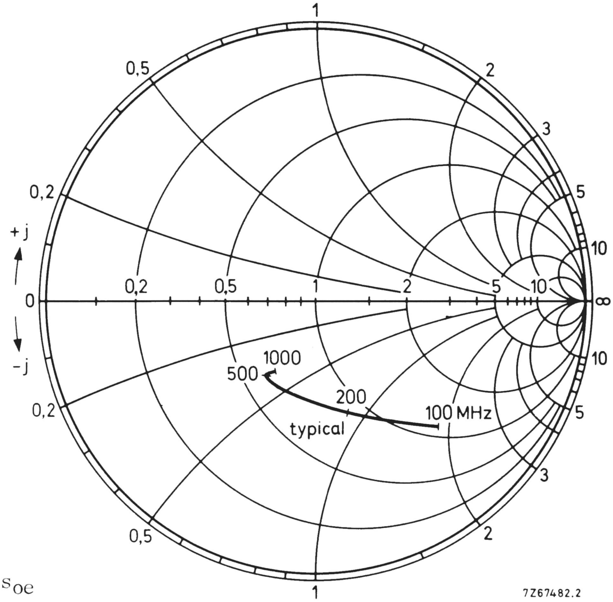


Reverse transmission coefficient s_{re}

V_{CE} = 20 V

I_C = 90 mA

T_{amb} = 25 °C

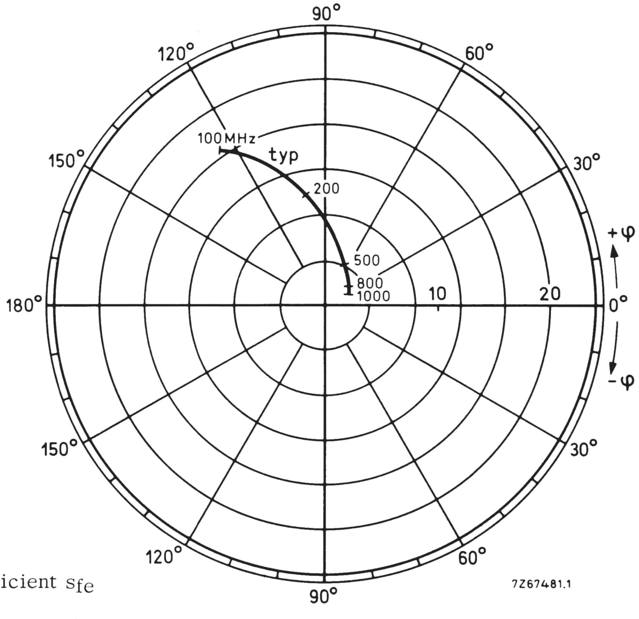


Output reflection coefficient s_{oe}

V_{CE} = 20 V

I_C = 90 mA

T_{amb} = 25 °C



Forward transmission coefficient s_{fe}

APPLICATION INFORMATION (see page 9) T_{amb} = 25 °C unless otherwise specified

Cross modulation distortion (channel 13) [1]

I_C = 90 mA; V_{CE} = 20 V; V_o = 48 dBmV	d_{cm}	typ. <	-61 -57	dB dB
I_C = 90 mA; V_{CE} = 20 V; V_o = 32 dBmV	d_{cm}	typ. <	-93 -89	dB dB

Intermodulation distortion

I_C = 90 mA; V_{CE} = 20 V; R_L = 75 Ω

$V_p = V_o$ = 60 dBmV at f_p = 196,25 MHz
$V_q = V_o$ −6 dB at f_q = 203,25 MHz
$V_r = V_o$ −6 dB at f_r = 205,25 MHz

Measured at $f_{(p+q-r)}$ = 194,25 MHz	d_{im}	typ.	-63	dB

Broadband power gain

I_C = 90 mA; V_{CE} = 20 V	G_p	> typ.	10 11	dB dB

Noise figure

I_C = 90 mA; V_{CE} = 20 V; f = 200 MHz	F	typ. <	8 10	dB dB

2nd harmonic distortion

I_C = 90 mA; V_{CE} = 20 V

f_p = 66 MHz; f_q = 144 MHz; $f_p + f_q$ = 210 MHz; V_o = 48 dBmV	d_2	<	-56	dB

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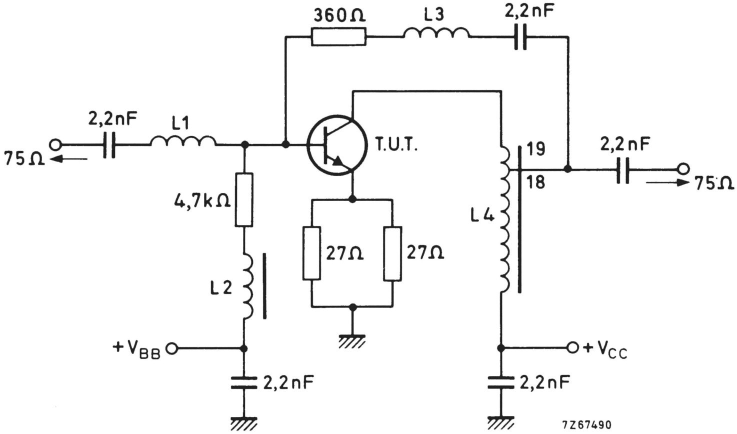
[1] In 12-channel measuring equipment; channel 13 unmodulated.
V_o = output level/signal, according to NCTA measuring standard.

APPLICATION INFORMATION (continued)

CATV test circuit

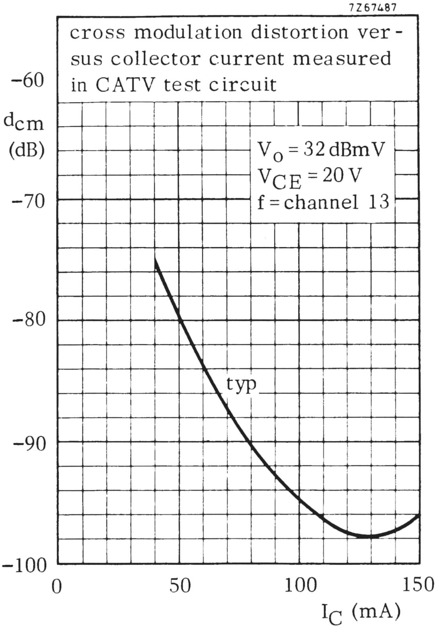

360Ω
L3
2,2nF
2,2nF
L1
75Ω
T.U.T.
19
18
2,2nF
75Ω
4,7kΩ
L4
27Ω
27Ω
L2
+V_BB
+V_CC
2,2nF
2,2nF
7Z67490

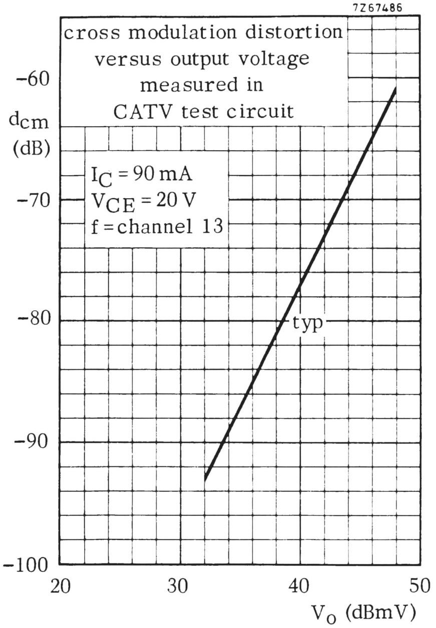
Frequency range 40 to 300 MHz (flatness gain ±0, 2 dB)

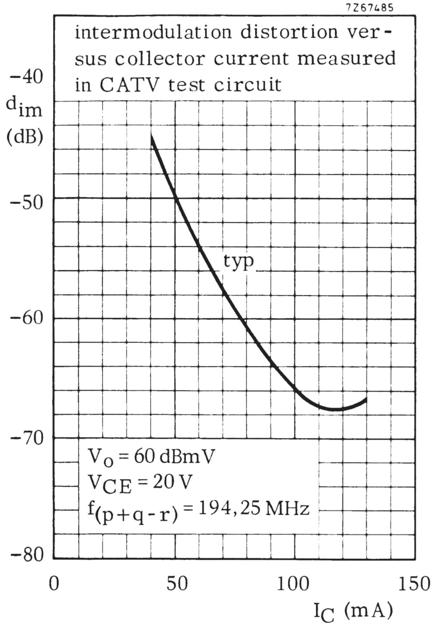
Return losses input and output		<	−16 dB
Power gain	G_p	typ.	11 dB

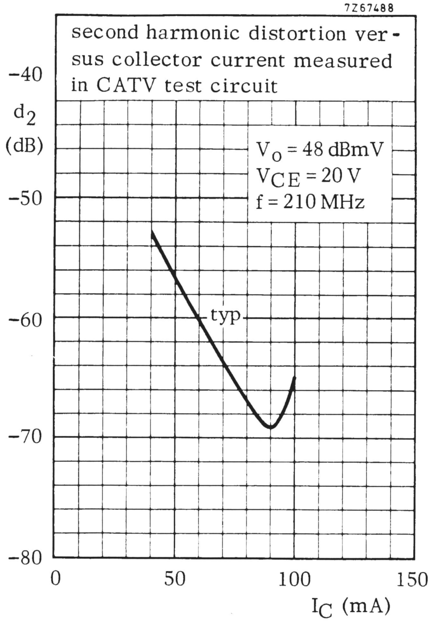
L1 = 2 turns closely wound enamelled Cu wire (0, 7 mm); int. diam. 3 mm
L2 = 5 μH ferroxcube coil (code number 3122 108 20153)
L3 = 5 turns closely wound enamelled Cu wire (0, 7 mm); int. diam. 4, 7 mm
L4 = 19 turns enamelled Cu wire (0, 3 mm) on ferroxcube core (code no. 4322 020 91001)

APPLICATION INFORMATION (continued)









SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N resistance stabilized transistor in a TO-39 metal envelope.

Due to very linear characteristics the transistor features low cross modulation, intermodulation and second harmonic distortion. Thanks to its high transition frequency it has a high power gain combined with excellent wideband properties and low noise up to high frequencies.

The BFR95 is primarily intended for CATV and MATV applications.

QUICK REFERENCE DATA

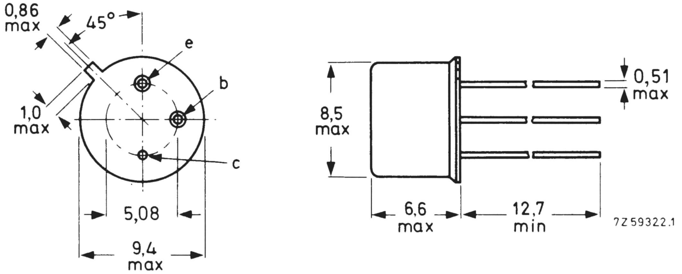
Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (d.c.)	I_C	max.	150	mA
Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1,5	W
Junction temperature	T_j	max.	200	°C
Transition frequency at f = 500 MHz I_C = 80 mA; V_{CE} = 20 V	f_T	typ.	3,5	GHz
Cross modulation distortion (channel 13) I_C = 80 mA; V_{CE} = 18 V; V_o = 48 dBmV	d_{cm}	typ. $<$	−61 −57	dB dB
I_C = 80 mA; V_{CE} = 18 V; V_o = 32 dBmV	d_{cm}	typ. $<$	−93 −89	dB dB
Intermodulation distortion at $f_{(p+q-r)}$ = 194,25 MHz I_C = 80 mA; V_{CE} = 18 V; V_o = 60 dBmV	d_{im}	typ.	−64	dB
Broadband power gain I_C = 80 mA; V_{CE} = 18 V	G_p	$>$ typ.	8 9	dB dB
Noise figure at f = 200 MHz I_C = 80 mA; V_{CE} = 18 V	F	typ. $<$	9 10	dB dB
Second harmonic distortion at $f_{(p+q)}$ = 210 MHz I_C = 80 mA; V_{CE} = 18 V; V_o = 48 dBmV	d_2	typ.	−62	dB

MECHANICAL DATA see page 2.

MECHANICAL DATA

Fig. 1 TO-39 Dimensions in mm

Collector connected to case



Maximum lead diameter guaranteed only for 12,7 mm.
Accessories: 56245 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter) note 1	V_{CBO}	max.	30 V
Collector-emitter voltage (R_{BE} = 10 Ω) note 2	V_{CER}	max.	35 V
Collector-emitter voltage (open base) note 2	V_{CEO}	max.	25 V
Emitter-base voltage (open collector) note 3	V_{EBO}	max.	3 V
Collector current (d.c.)	I_C	max.	150 mA
Collector current (peak value); f > 1 MHz	I_{CM}	max.	300 mA
Total power dissipation			
up to T_{amb} = 25 °C	P_{tot}	max.	0,7 W
up to T_{mb} = 125 °C	P_{tot}	max.	1,5 W
Storage temperature	T_{stg}	−65 to + 200 °C	
Junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE (note 4)

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	250 K/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	50 K/W

Notes

1. At I_C = 100 μA.
2. At I_C = 10 mA.
3. At I_E = 100 μA.
4. K/W is SI unit for °C/W.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	50 μA
D.C. current gain (note 1)			
$I_C = 50$ mA; $V_{CE} = 20$ V	h_{FE}	>	30
$I_C = 150$ mA; $V_{CE} = 20$ V	h_{FE}	>	30
Transition frequency at f = 500 MHz (note 1)			
$I_C = 80$ mA; $V_{CE} = 20$ V	f_T	typ.	3,5 GHz
$I_C = 150$ mA; $V_{CE} = 20$ V	f_T	typ.	3,5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	typ.	3,5 pF
Feedback capacitance at f = 1 MHz			
$I_C = 10$ mA; $V_{CE} = 20$ V	C_{re}	typ.	1,6 pF

APPLICATION INFORMATION (see also test circuit on page 4)

Measuring conditions: $I_C = 80$ mA; $V_{CE} = 18$ V; $T_{amb} = 25$ °C

Cross modulation (channel 13) (note 2)			
$V_o = 48$ dBmV	d_{cm}	typ.	−61 dB
		<	−57 dB
$V_o = 32$ dBmV	d_{cm}	typ.	−93 dB
		<	−89 dB
Intermodulation distortion $V_p = V_o = 60$ dBmV at $f_p = 196{,}25$ MHz $V_q = V_o - 6$ dB at $f_q = 203{,}25$ MHz $V_r = V_o - 6$ dB at $f_r = 205{,}25$ MHz			
Measured at $f_{(p+q-r)} = 194{,}25$ MHz	d_{im}	typ.	−64 dB
Broadband power gain	G_p	>	8 dB
		typ.	9 dB
Noise figure at f = 200 MHz	F	typ.	9 dB
		<	10 dB
2nd harmonic distortion at $f_{(p+q)} = 210$ MHz $f_p = 66$ MHz; $f_q = 144$ MHz; $V_o = 48$ dBmV	d_2	typ.	−62 dB
		<	−56 dB

Notes

1. Measured under pulse conditions.
2. In 12-channel measuring equipment; channel 13 unmodulated.
   V_o = output level/signal, in accordance with NCTA measuring standard.

APPLICATION INFORMATION

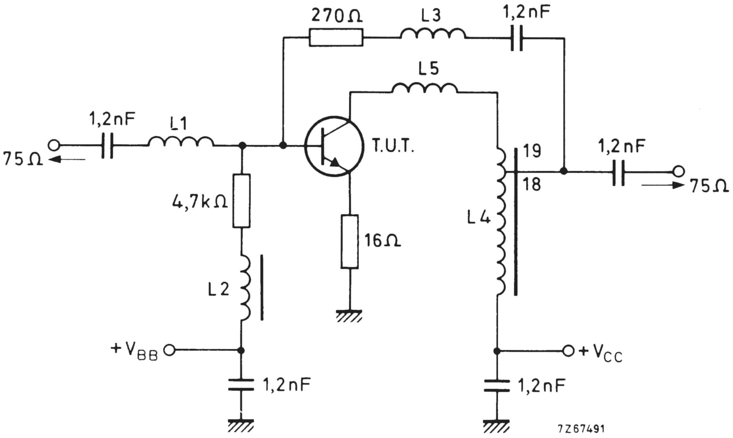

270Ω
L3
1,2nF
L5
1,2nF
L1
75Ω
T.U.T.
19
18
1,2nF
75Ω
4,7kΩ
L4
16Ω
L2
+V_BB
+V_CC
1,2nF
1,2nF
7Z67491

Fig. 2 CATV test circuit.
Frequency range 40 to 300 MHz
Power gain G_p typ. 9 dB

L1 = 2 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 3 mm
L2 = 5 μH Ferroxcube coil (cat. no. 3122 108 20153)
L3 = 3 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 4,7 mm
L4 = 19 turns enamelled Cu wire (0,3 mm) on Ferroxcube core (cat. no. 4322 020 91001)
L5 = 2 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 3 mm.

THE BFR96S IS RECOMMENDED
FOR NEW DESIGN

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers, etc.
The transistor features very low intermodulation distortion and high power gain; thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	75	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	500	mW
Junction temperature	T_j	max.	175	°C
Transition frequency at f = 500 MHz I_C = 50 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	C_{re}	<	1,4	pF
Noise figure at optimum source impedance I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	3,3	dB
Max. unilateral power gain (see page 3) I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	15,2	dB
Intermodulation distortion at T_{amb} = 25 °C I_C = 50 mA; V_{CE} = 10 V; R_L = 75 Ω; V_o = 500 mV $f_{(p+q-r)}$ = 493,25 MHz (see page 4)	d_{im}	typ.	−60	dB

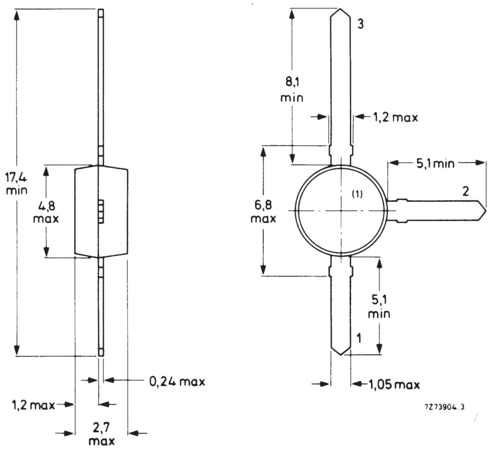
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,0	V

Currents

Collector current (d.c.)	I_C	max.	75	mA
Collector current (peak value); f > 1 MHz	I_{CM}	max.	150	mA

Power dissipation

Total power dissipation up to T_{amb} = 60 °C mounted on a fibre-glass print of 40 mm x 35 mm x 1,5 mm	P_{tot}	max.	500	mW

Temperatures

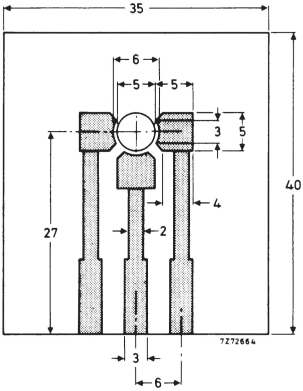
Storage temperature	T_{stg}	-65 to +175		°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print of 40 mm x 35 mm x 1.5 mm	$R_{th\ j\text{-}a}$	=	0.23	°C/mW

Requirements for fibre-glass print

Dimensions in mm



Single-sided 35 µm Cu-clad epoxy fibre-glass print, thickness 1,5 mm.
Tracks are fully tin-lead plated.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	$<$	100	nA
D.C. current gain [1]				
$I_C = 50$ mA; $V_{CE} = 10$ V	h_{FE}	$>$	25	
		typ.	50	
$I_C = 75$ mA; $V_{CE} = 10$ V	h_{FE}	$>$	25	
		typ.	52	
Transition frequency at f = 500 MHz [1]				
$I_C = 50$ mA; $V_{CE} = 10$ V	f_T	$>$	4,0	GHz
		typ.	5,0	GHz
$I_C = 75$ mA; $V_{CE} = 10$ V	f_T	$>$	4,4	GHz
		typ.	5,5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	1,3	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	typ.	6,5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 10$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	C_{re}	typ.	1,0	pF
		$<$	1,4	pF
Noise figure at optimum source impedance				
$I_C = 50$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	F	typ.	3,3	dB
$I_C = 50$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	F	typ.	3,8	dB

Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 50$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	G_{UM}	typ.	15,2	dB

---

[1] Measured under pulse conditions.

CHARACTERISTICS (continued)

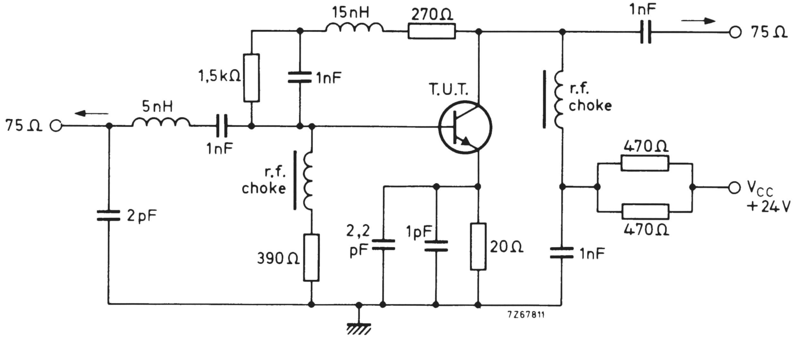
Intermodulation distortion at T_{amb} = 25 °C

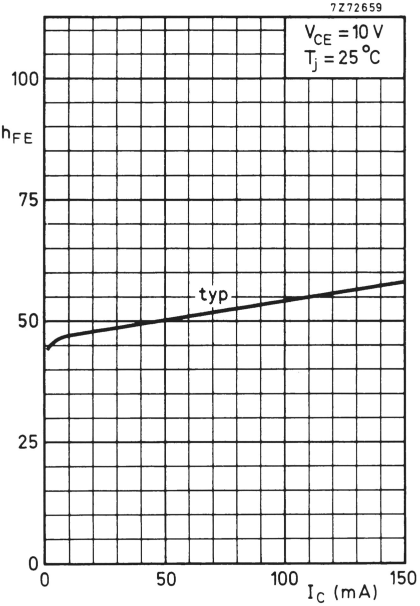
I_C = 50 mA; V_{CE} = 10 V; R_L = 75 Ω

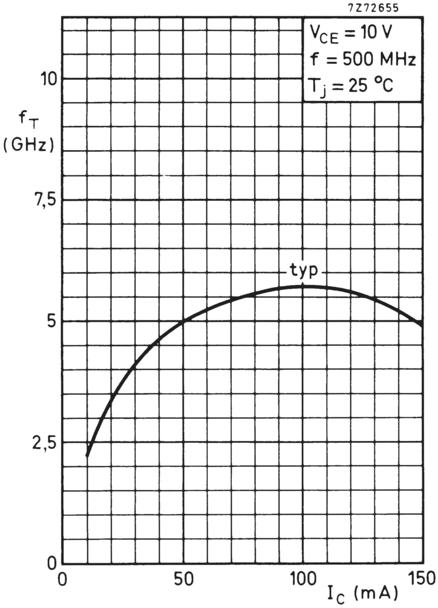
$V_p = V_o$ = 500 mV at f_p = 495.25 MHz
$V_q = V_o$ − 6 dB at f_q = 503.25 MHz
$V_r = V_o$ − 6 dB at f_r = 505,25 MHz

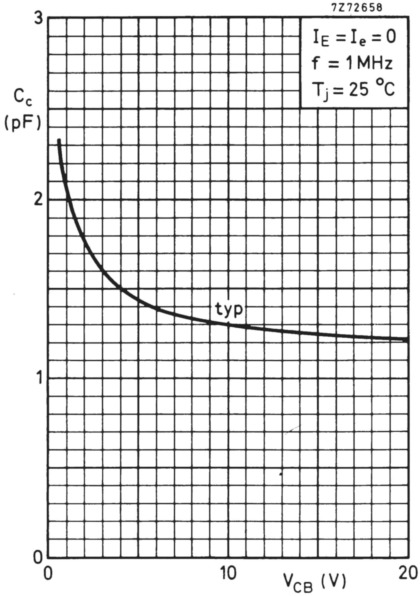
Measured at $f_{(p+q-r)}$ = 493,25 MHz d_{im} typ. −60 dB

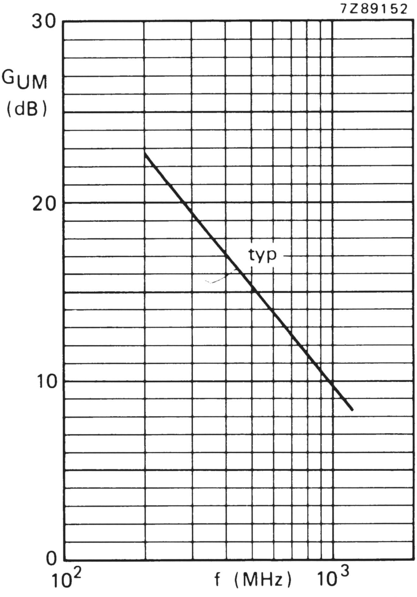
Intermodulation test circuit:


15nH
270Ω
1nF
75Ω
1,5kΩ
1nF
T.U.T.
r.f. choke
75Ω
5nH
1nF
470Ω
r.f. choke
VCC +24V
470Ω
2pF
2,2 pF
1pF
20Ω
1nF
390Ω
7Z67811







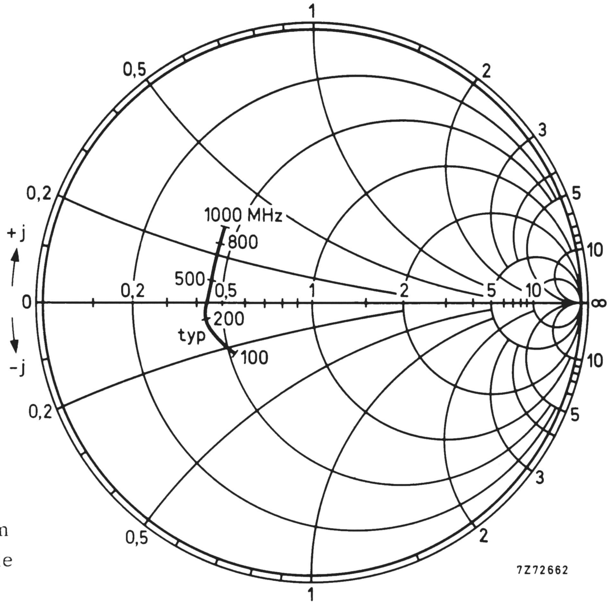


V_{CE} = 10 V; I_C = 50 mA; T_{amb} = 25 °C.

V_{CE} = 10 V

I_C = 50 mA

T_{amb} = 25 °C

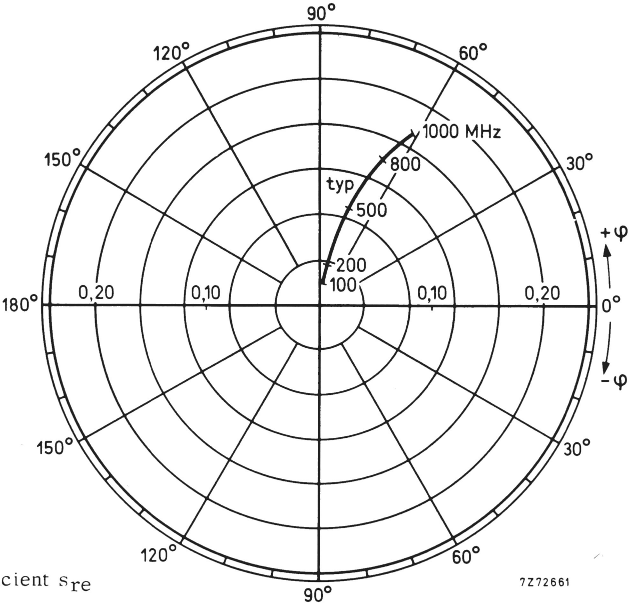


Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50

V_{CE} = 10 V

I_C = 50 mA

T_{amb} = 25 °C

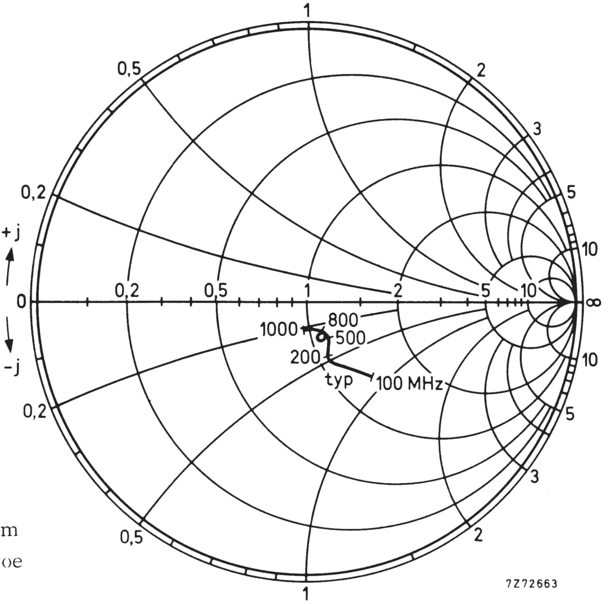


Reverse transmission coefficient s_{re}

V_{CE} = 10 V

I_C = 50 mA

T_{amb} = 25 °C

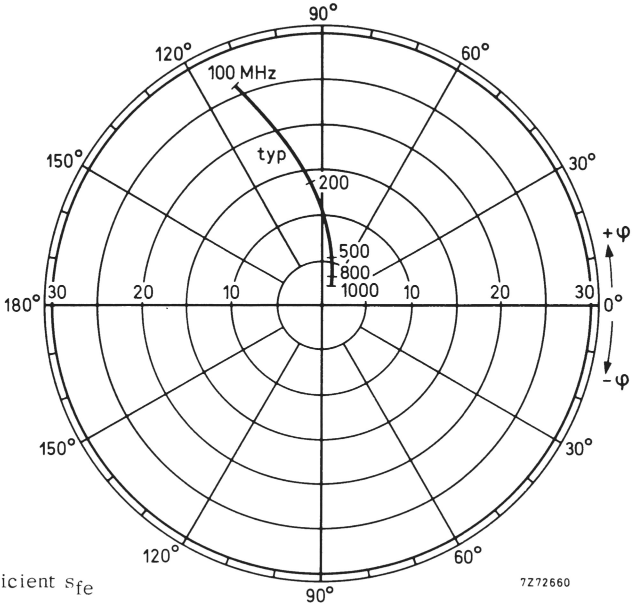


Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50

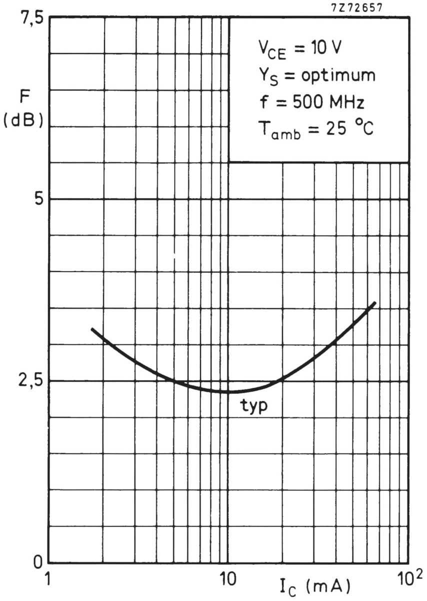
V_{CE} = 10 V

I_C = 50 mA

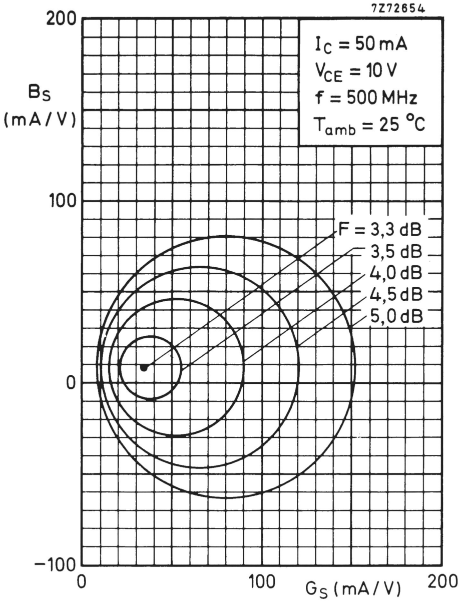
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}



circles of constant noise figure



SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a plastic T-package, primarily intended for MATV applications. The device features excellent output voltage capabilities.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	700	mW
Junction temperature	T_j	max.	175	°C
Transition frequency at f = 500 MHz I_C = 70 mA; V_{CE} = 10 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V	C_{re}	typ.	1	pF
Noise figure at optimum source impedance I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	F	typ.	4,0	dB
Maximum unilateral power gain I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	11,5	dB
Output voltage at d_{im} = −60 dB (see Fig. 3) I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793,25 MHz	V_o	typ.	700	mV

MECHANICAL DATA

SOT-37 (see Fig. 1).

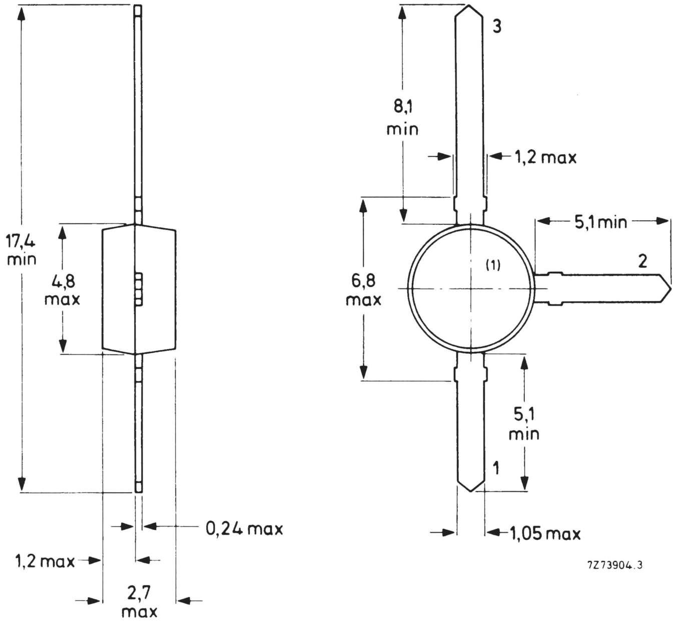
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector


17,4 min
4,8 max
0,24 max
1,2 max
2,7 max
3
8,1 min
1,2 max
5,1 min
(1)
2
6,8 max
5,1 min
1
1,05 max
7Z73904.3

(1) = type number marking.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,0	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 70 °C mounted on a fibre-glass print (see Fig. 2) of 50 mm x 50 mm x 1,5 mm	P_{tot}	max.	700	mW
Storage temperature	T_{stg}	−65 to + 175		°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a fibre-glass print (see Fig. 2) of 50 mm x 50 mm x 1,5 mm	$R_{th\ j\text{-}a}$	=	150	K/W*

* K/W is SI unit for °C/W.

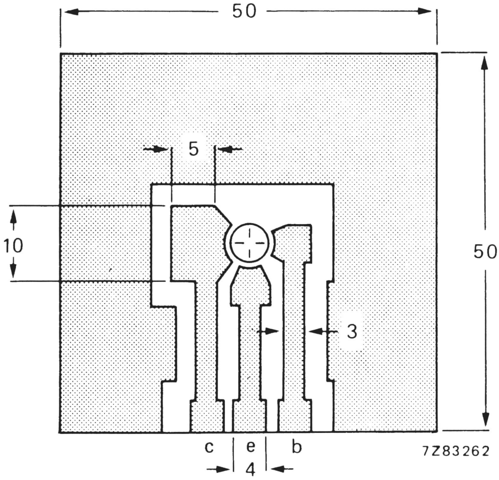


Fig. 2 Requirements for fibre-glass print. (Dimensions in mm.) Single-sided 35 μm Cu-clad epoxy fibre-glass print, thickness 1,5 mm. Tracks are fully tin-lead plated. Shaded area is Cu.

CHARACTERISTICS

$T_j = 25\ ^\circ C$ unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	$<$	100 nA
D.C. current gain* $I_C = 70$ mA; $V_{CE} = 10$ V	h_{FE}	$>$	25
Transition frequency at f = 500 MHz $I_C = 70$ mA; $V_{CE} = 10$ V	f_T	typ.	5 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	1,5 pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $V_{EB} = 0{,}5$ V	C_e	typ.	6,5 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 10$ V; $T_{amb} = 25\ ^\circ C$	C_{re}	typ.	1 pF
Noise figure at optimum source impedance $I_C = 70$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25\ ^\circ C$	F	typ.	4,0 dB

Maximum unilateral power gain (s_{re} assumed to be zero)

$$G_{UM} \text{ (in dB)} = 10 \log \frac{|s_{fe}|^2}{(1-|s_{ie}|^2)\,(1-|s_{oe}|^2)}$$

$I_C = 70$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25\ ^\circ C$	G_{UM}	typ.	11,5 dB

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* Measured under pulse conditions.

s-parameters (common emitter) at V_{CE} = 5 V

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
5	40	0,75/ −41,5°	0,026/+ 69,1°	15,1/+ 155,2°	0,93/ −17,4°
	200	0,62/−128,1°	0,064/+ 41,9°	7,1/+ 106,9°	0,53/ −43,3°
	500	0,55/−174,6°	0,087/+ 47,0°	3,2/ + 79,8°	0,40/ −53,2°
	800	0,56/+ 158,7°	0,115/+ 56,5°	2,1/ + 65,0°	0,39/ −63,2°
	1000	0,58/+ 146,7°	0,135/+ 59,2°	1,7/ + 56,6°	0,39/ −72,5°
	1200	0,61/+ 135,5°	0,159/+ 61,7°	1,4/ + 48,9°	0,39/ −83,0°
10	40	0,60/ −59,1°	0,022/+ 64,1°	24,3/+ 147,2°	0,86/ −26,6°
	200	0,54/−146,1°	0,050/+ 49,4°	9,1/+ 100,7°	0,38/ −54,7°
	500	0,50/+ 175,8°	0,087/+ 59,3°	3,9/ + 78,6°	0,27/ −62,8°
	800	0,52/+ 152,4°	0,129/+ 63,7°	2,5/ + 65,8°	0,27/ −72,2°
	1000	0,53/+ 141,0°	0,157/+ 63,9°	2,1/ + 58,0°	0,27/ −80,7°
	1200	0,56/+ 130,7°	0,186/+ 63,3°	1,7/ + 51,2°	0,27/ −90,9°
30	40	0,39/−105,6°	0,015/+ 60,7°	39,6/+ 133,3°	0,69/ −44,1°
	200	0,44/−168,4°	0,041/+ 65,9°	11,1/ + 94,3°	0,23/ −78,2°
	500	0,46/+ 165,1°	0,094/+ 70,3°	4,7/ + 77,3°	0,16/ −88,4°
	800	0,48/+ 145,4°	0,146/+ 69,2°	3,0/ + 66,5°	0,16/ −98,3°
	1000	0,51/+ 135,6°	0,175/+ 66,6°	2,5/ + 60,1°	0,16/−109,3°
	1200	0,53/+ 126,2°	0,206/+ 64,2°	2,1/ + 54,0°	0,17/−119,7°
50	40	0,37/−129,3°	0,013/+ 63,4°	44,6/+ 127,8°	0,62/ −51,4°
	200	0,43/−174,7°	0,040/+ 71,5°	11,5/ + 92,5°	0,19/ −89,2°
	500	0,45/+ 162,4°	0,095/+ 72,7°	4,8/ + 76,8°	0,14/−101,5°
	800	0,48/+ 143,4°	0,151/+ 70,1°	3,1/ + 66,5°	0,14/−111,5°
	1000	0,50/+ 134,3°	0,182/+ 67,4°	2,5/ + 60,4°	0,14/−121,5°
	1200	0,52/+ 124,9°	0,215/+ 64,8°	2,1/ + 54,6°	0,15/−130,7°
70	40	0,38/−141,7°	0,011/+ 65,1°	46,9/+ 124,9°	0,57/ −55,8°
	200	0,43/−177,6°	0,040/+ 73,7°	11,6/ + 91,6°	0,18/ −96,3°
	500	0,46/+ 161,2°	0,095/+ 73,9°	4,9/ + 76,5°	0,13/−109,5°
	800	0,49/+ 143,1°	0,150/+ 70,6°	3,1/ + 66,4°	0,13/−120,7°
	1000	0,49/+ 133,5°	0,186/+ 67,7°	2,5/ + 60,2°	0,14/−126,2°
	1200	0,52/+ 124,1°	0,218/+ 65,0°	2,1/ + 54,6°	0,15/−135,3°

s-parameters (common emitter) at V_{CE} = 10 V

I_C mA	f MHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
5	40	0,77/ −38,9°	0,023/+ 69,1°	15,2/+ 156,2°	0,93/ −15,4°
	200	0,62/−124,0°	0,059/+ 43,1°	7,4/+ 108,3°	0,57/ −38,0°
	500	0,54/−172,5°	0,081/+ 48,0°	3,4/ + 80,8°	0,45/ −46,8°
	800	0,55/+ 159,9°	0,106/+ 57,8°	2,2/ + 65,9°	0,43/ −57,1°
	1000	0,56/+ 147,2°	0,126/+ 61,5°	1,8/ + 57,5°	0,43/ −64,9°
	1200	0,58/+ 135,9°	0,150/+ 64,4°	1,5/ + 50,1°	0,42/ −74,7°
10	40	0,62/ −54,5°	0,020/+ 64,9°	24,5/+ 148,7°	0,87/ −23,5°
	200	0,53/−142,3°	0,046/+ 49,6°	9,6/+ 102,0°	0,42/ −47,8°
	500	0,48/+ 177,6°	0,080/+ 59,4°	4,2/ + 79,4°	0,31/ −54,2°
	800	0,50/+ 153,2°	0,118/+ 64,0°	2,7/ + 66,4°	0,31/ −63,5°
	1000	0,52/+ 142,3°	0,143/+ 64,1°	2,2/ + 59,1°	0,31/ −70,0°
	1200	0,54/+ 131,8°	0,168/+ 64,3°	1,8/ + 52,4°	0,30/ −79,5°
30	40	0,41/ −94,4°	0,014/+ 62,2°	40,9/+ 135,0°	0,72/ −39,2°
	200	0,42/−164,6°	0,039/+ 65,5°	11,8/ + 95,1°	0,25/ −64,5°
	500	0,42/+ 167,0°	0,087/+ 70,4°	4,9/ + 77,9°	0,19/ −71,1°
	800	0,45/+ 146,6°	0,136/+ 69,3°	3,2/ + 67,1°	0,18/ −79,1°
	1000	0,47/+ 136,6°	0,166/+ 67,2°	2,6/ + 60,6°	0,18/ −83,8°
	1200	0,49/+ 126,3°	0,196/+ 65,0°	2,2/ + 54,6°	0,17/ −95,1°
50	40	0,36/−114,4°	0,012/+ 62,7°	46,5/+ 129,6°	0,63/ −45,7°
	200	0,40/−171,0°	0,038/+ 70,4°	12,3/ + 93,1°	0,20/ −71,4°
	500	0,41/+ 163,9°	0,090/+ 72,4°	5,1/ + 77,1°	0,16/ −79,7°
	800	0,44/+ 144,7°	0,140/+ 70,1°	3,3/ + 66,7°	0,15/ −86,0°
	1000	0,47/+ 135,3°	0,168/+ 67,3°	2,7/ + 60,8°	0,14/ −95,3°
	1200	0,49/+ 125,2°	0,197/+ 65,0°	2,3/ + 55,2°	0,14/−106,6°
70	40	0,35/−125,4°	0,012/+ 63,6°	49,1/+ 125,7°	0,58/ −49,5°
	200	0,40/−173,7°	0,038/+ 72,7°	12,4/ + 92,0°	0,18/ −74,8°
	500	0,41/+ 162,6°	0,091/+ 73,2°	5,2/ + 76,7°	0,15/ −82,0°
	800	0,44/+ 144,1°	0,143/+ 70,2°	3,3/ + 66,4°	0,14/ −87,4°
	1000	0,46/+ 134,6°	0,175/+ 67,3°	2,7/ + 60,2°	0,13/ −95,3°
	1200	0,48/+ 124,1°	0,200/+ 64,8°	2,3/ + 54,6°	0,13/−109,5°

Output voltage at d_{im} = –60 dB (see Figs 3 and 5)
(DIN45004B, par. 6.3: 3-tone)
I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = –60 dB; f_p = 795,25 MHz
$V_q = V_o$ –6 dB; f_q = 803,25 MHz
$V_r = V_o$ –6 dB; f_r = 805,25 MHz
Measured at $f_{(p+q-r)}$ = 793,25 MHz — V_o typ. 700 mV

Second harmonic distortion (see Figs 3 and 6)
I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ = 316 mV = 50 dBmV; f_p = 250 MHz
$V_q = V_o$ = 316 mV = 50 dBmV; f_q = 560 MHz
measured at $f_{(p+q)}$ = 810 MHz — d_2 typ. –52 dB

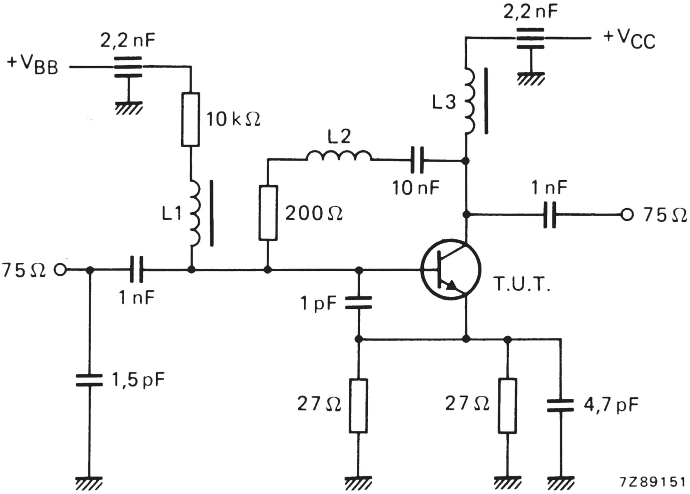

2,2 nF
+V_{BB}
10 kΩ
L1
75 Ω
1 nF
1,5 pF
L2
200 Ω
10 nF
1 pF
27 Ω
2,2 nF
+V_{CC}
L3
1 nF
75 Ω
T.U.T.
27 Ω
4,7 pF
7Z89151

Fig. 3 Intermodulation distortion and second harmonic distortion MATV test circuit.

L1 = L3 = 5 μH micro choke
L2 = 1½ turns Cu wire (0,4 mm); internal diameter 3,0 mm; winding pitch 1 mm

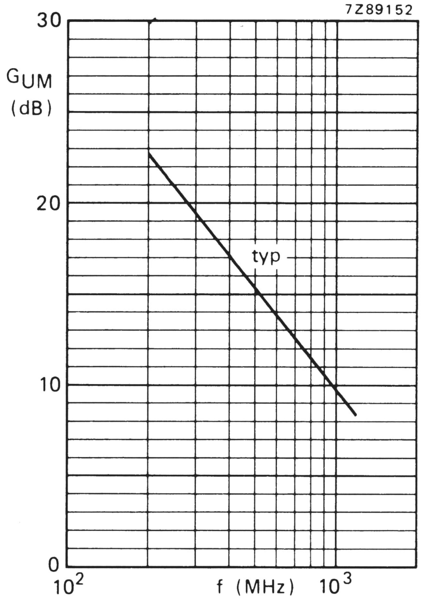


Fig. 4 V_{CE} = 10 V; I_C = 70 mA; T_{amb} = 25 °C.

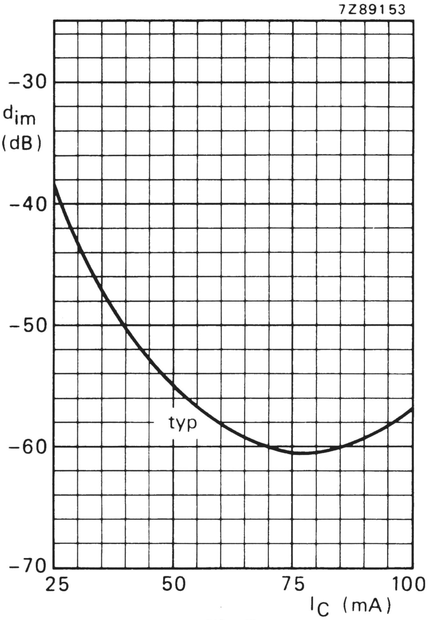


Fig. 5.

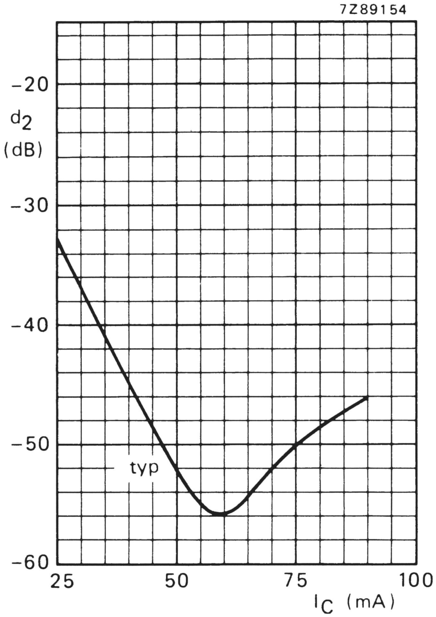


Fig. 6.

Intermodulation distortion (Fig. 5) and second harmonic distortion (Fig. 6) are measured in MATV circuit (see Fig. 3).

Fig. 5 V_{CE} = 10 V; V_o = 700 mV = 56,9 dBmV; $f_{(p+q-r)}$ = 793,25 MHz; T_{amb} = 25 °C.

Fig. 6 V_{CE} = 10 V; V_o = 316 mV = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

Conditions for Figs 7 and 8:

V_{CE} = 10 V; I_C = 70 mA;
T_{amb} = 25 °C.

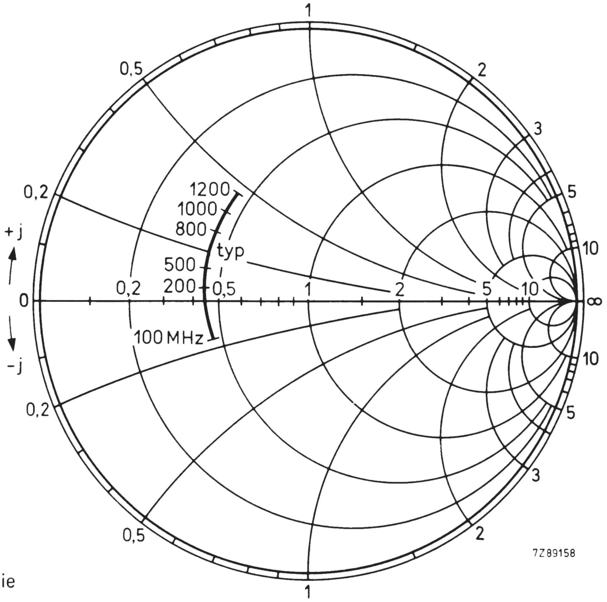


Fig. 7 Input impedance derived from input reflection coefficient s_{ie} co-ordinates in ohm x 50.

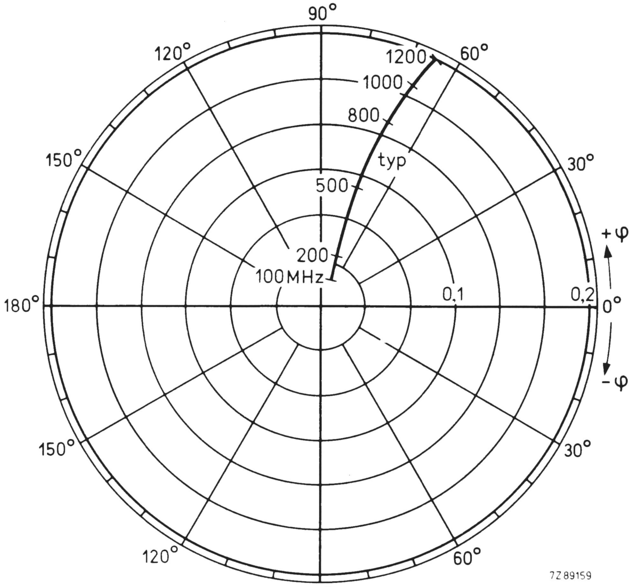


Fig. 8 Reverse transmission coefficient s_{re}.

Conditions for Figs 9 and 10:

V_{CE} = 10 V; I_C = 70 mA;
T_{amb} = 25 °C.

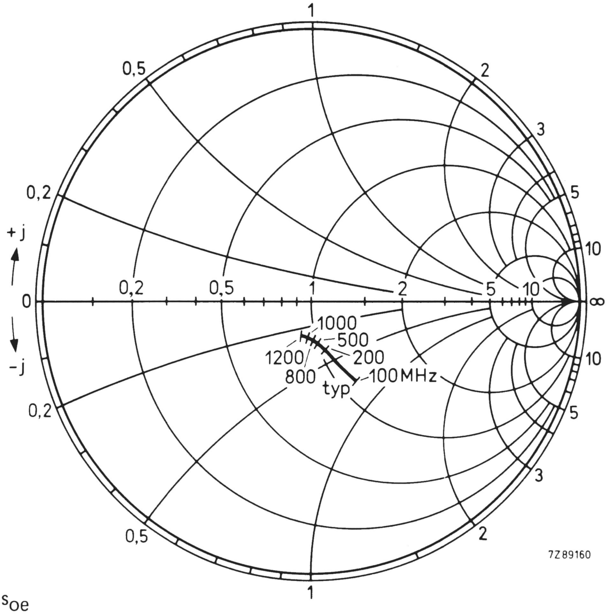


Fig. 9 Output impedance derived from output reflection coefficient s_{oe} co-ordinates in ohm x 50.

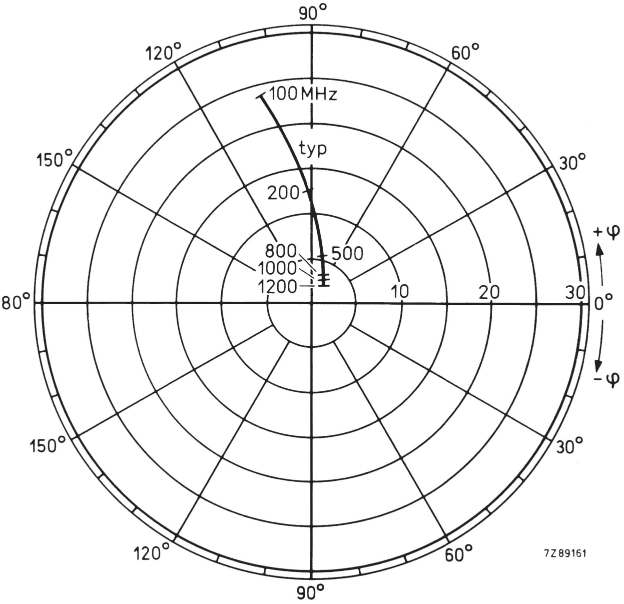


Fig. 10 Forward transmission coefficient s_{fe}.

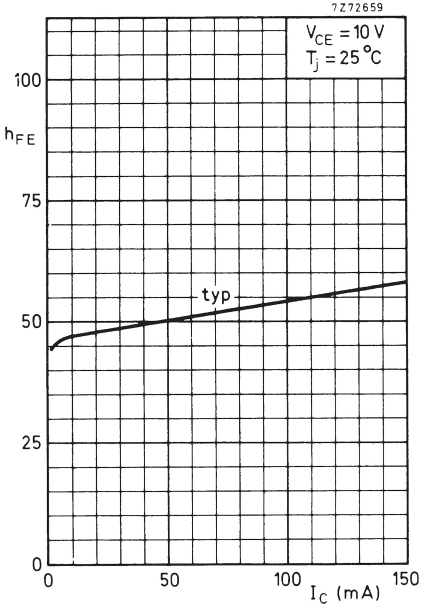


Fig. 11.

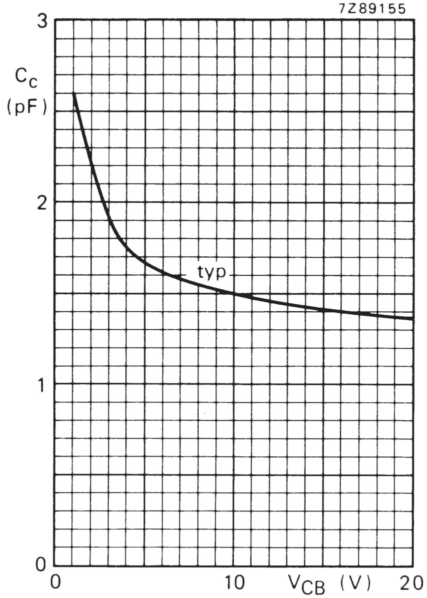


Fig. 12 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

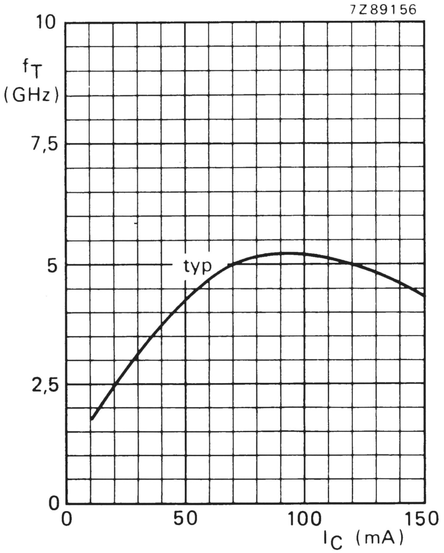


Fig. 13 V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

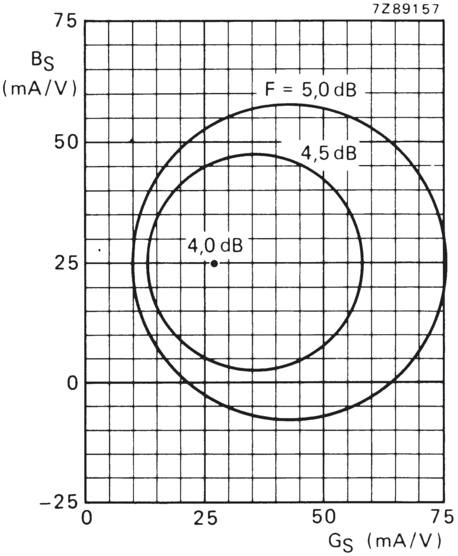


Fig. 14 Circles of constant noise figure.
V_{CE} = 10 V; I_C = 70 mA; f = 800 MHz;
T_{amb} = 25 °C; typical values.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
It is primarily intended for use in u.h.f. low power amplifiers such as in pocket phones, paging systems, etc.
The transistor features low current consumption (100 μA - 1 mA); thanks to its high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	8	V
Collector-emitter voltage (open base)	V_{CEO}	max.	5	V
Collector current (d.c.)	I_C	max.	2,5	mA
Total power dissipation up to T_{amb} = 135 °C	P_{tot}	max.	30	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 1 mA; V_{CE} = 1 V	f_T	typ.	2,3	GHz
Feedback capacitance at f = 1 MHz I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C	C_{re}	<	0,4	pF
Noise figure at optimum source impedance I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	3,8	dB
Max. unilateral power gain (see page 3) I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	17	dB

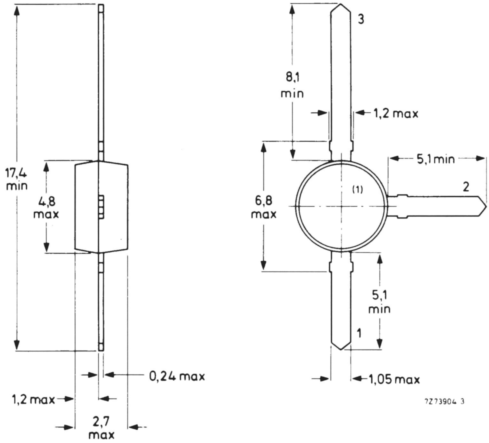
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages				
Collector-base voltage (open emitter)	V_{CBO}	max.	8	V
Collector-emitter voltage (open base)	V_{CEO}	max.	5	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Current				
Collector current (d.c.)	I_C	max.	2,5	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	5,0	mA
Power dissipation				
Total power dissipation up to T_{amb} = 135 °C	P_{tot}	max.	30	mW
Temperatures				
Storage temperature	T_{stg}	-65 to +150		°C
Junction temperature	T_j	max.	150	°C

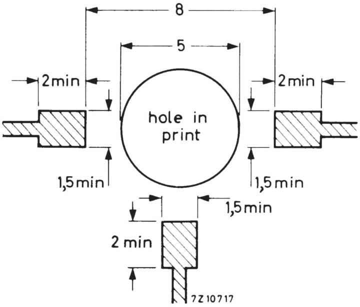
THERMAL RESISTANCE

From junction to ambient in free air

mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0,5	°C/mW

*) Requirements for glass-fibre print

(dimensions in mm)



CHARACTERISTICS $T_j = 25\ ^{o}C$ unless otherwise specified

Collector cut-off current				
$I_E = 0;\ V_{CB} = 5\ V$	I_{CBO}	$<$	50	nA
D.C. current gain 1)				
$I_C = 10\ \mu A;\ V_{CE} = 1\ V$	h_{FE}	$>$ typ.	20 30	
$I_C = 1\ mA;\ V_{CE} = 1\ V$	h_{FE}	$>$ typ.	20 40	
Saturation voltages				
$I_C = 10\ \mu A;\ I_B = 1\ \mu A$	V_{CEsat} V_{BEsat}	$<$ $<$	200 750	mV mV
$I_C = 1\ mA;\ I_B = 0,1\ mA$	V_{CEsat} V_{BEsat}	$<$ $<$	175 900	mV mV
Transition frequency at f = 500 MHz 1)				
$I_C = 1\ mA;\ V_{CE} = 1\ V$	f_T	$>$ typ.	1,2 2,3	GHz GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0;\ V_{CB} = 0,5\ V$	C_c	$<$	0,55	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0;\ V_{EB} = 0$	C_e	$<$	0,45	pF
Feedback capacitance at f = 1 MHz				
$I_C = 1\ mA;\ V_{CE} = 1\ V;\ T_{amb} = 25\ ^{o}C$	C_{re}	$<$	0,4	pF
Noise figure at optimum source impedance				
$I_C = 0,1\ mA;\ V_{CE} = 1\ V;\ f = 500\ MHz;\ T_{amb} = 25\ ^{o}C$	F	typ.	5,5	dB
$I_C = 1\ mA;\ V_{CE} = 1\ V;\ f = 500\ MHz;\ T_{amb} = 25\ ^{o}C$	F	typ.	3,8	dB

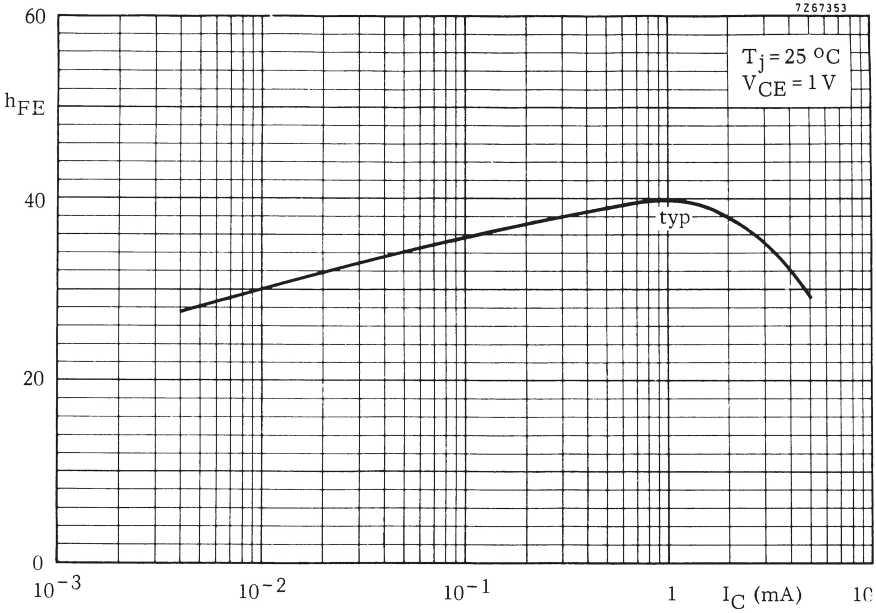
Max. unilateral power gain (s_{re} assumed to be zero)

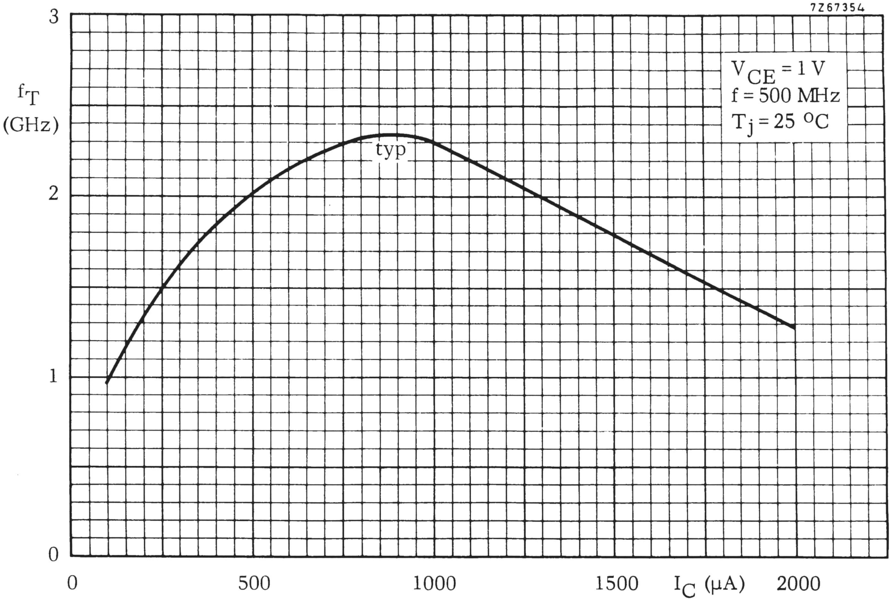
$$G_{UM}\ \text{(in dB)} = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

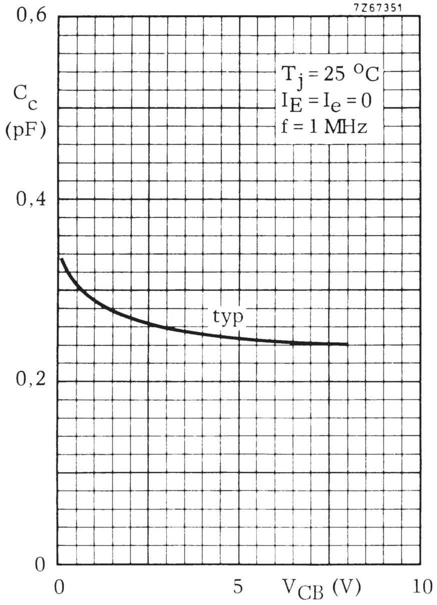
$I_C = 1\ mA;\ V_{CE} = 1\ V;\ f = 200\ MHz;\ T_{amb} = 25\ ^{o}C$	G_{UM}	typ.	24	dB
$I_C = 1\ mA;\ V_{CE} = 1\ V;\ f = 500\ MHz;\ T_{amb} = 25\ ^{o}C$	G_{UM}	typ.	17	dB
$I_C = 1\ mA;\ V_{CE} = 1\ V;\ f = 800\ MHz;\ T_{amb} = 25\ ^{o}C$	G_{UM}	typ.	11	dB

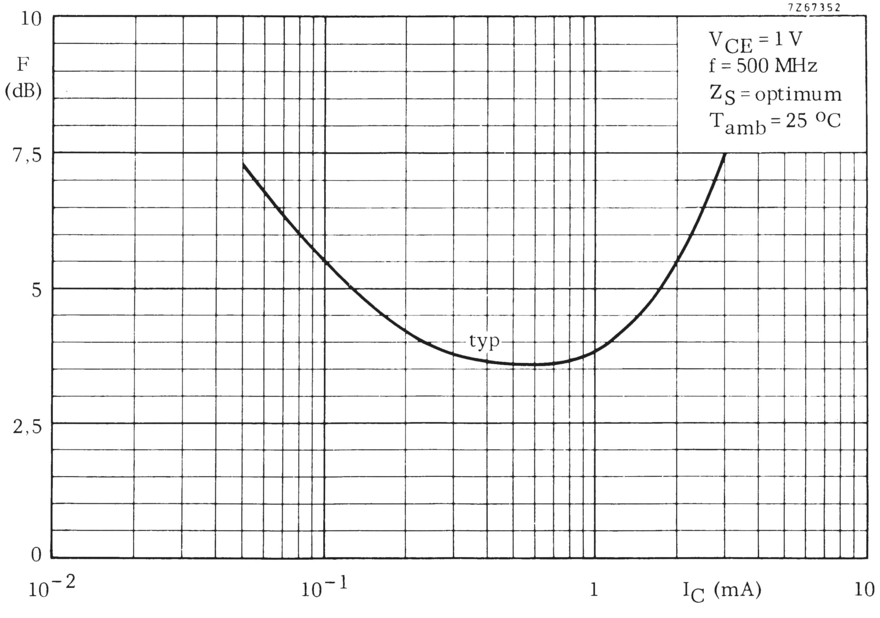
---

1) Measured under pulse conditions.

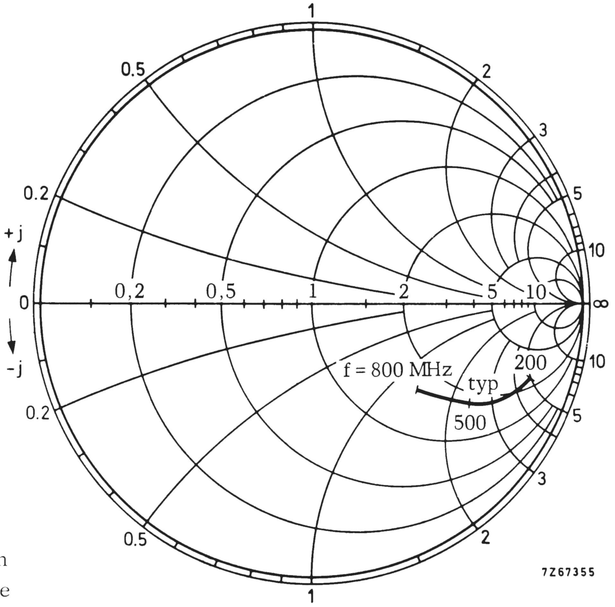

7Z67353
60
40
20
0
h_{FE}
$T_j = 25\ ^oC$
$V_{CE} = 1\ V$
typ
10^{-3}
10^{-2}
10^{-1}
1
I_C (mA)
10


7Z67354
3
2
1
0
f_T
(GHz)
$V_{CE} = 1\ V$
f = 500 MHz
$T_j = 25\ ^oC$
typ
0
500
1000
1500
I_C (μA)
2000


7Z67351
0,6
C_c
(pF)
0,4
0,2
0
$T_j = 25\ ^oC$
$I_E = I_e = 0$
f = 1 MHz
typ
0
5
V_{CB} (V)
10

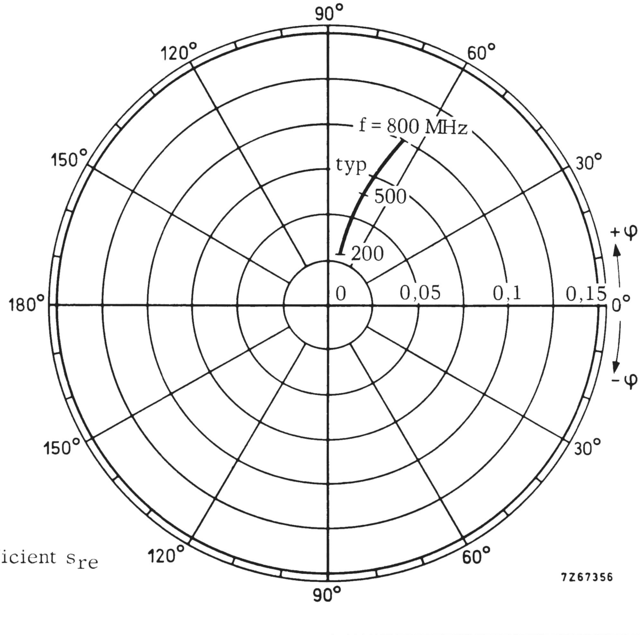

7Z67352
10
F
(dB)
7,5
5
2,5
0
$V_{CE} = 1$ V
f = 500 MHz
Z_S = optimum
$T_{amb} = 25\ ^oC$
typ
10^{-2}
10^{-1}
1
I_C (mA)
10

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 °C



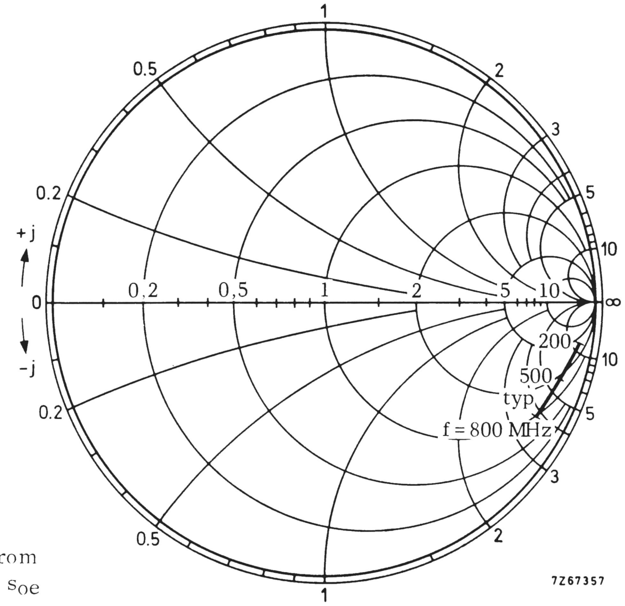
Input impedance derived from input reflection coefficient s_{ie} coordinates in ohm x 50

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 °C



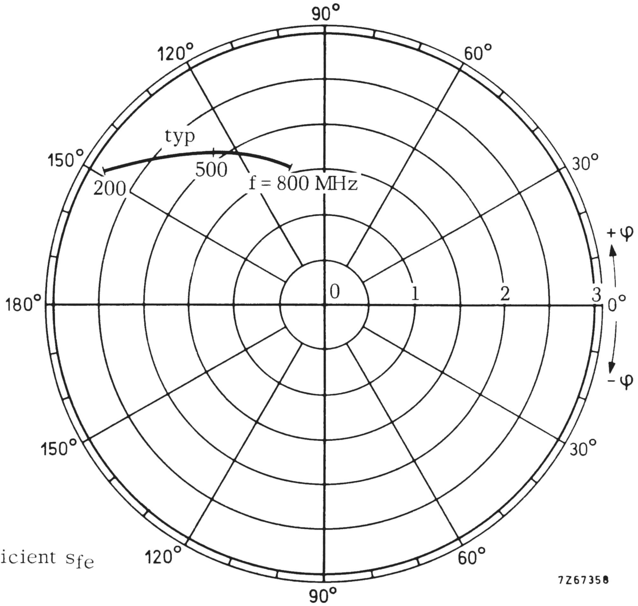
Reverse transmission coefficient s_{re}

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 °C



Output impedance derived from output reflection coefficient s_{oe} coordinates in ohm x 50

V_{CE} = 1 V
I_C = 1 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a TO-39 metal envelope, with the collector connected to the case. The transistor has extremely good intermodulation properties and a high power gain. It is a ruggedized version of the BFW16, which it succeeds. It is primarily intended for:

- Final and driver stages of channel and band aerial amplifiers with high output power for bands I, II, III and IV/V (40–860 MHz).
- Final stage of the wideband vertical amplifier in high speed oscilloscopes.

QUICK REFERENCE DATA

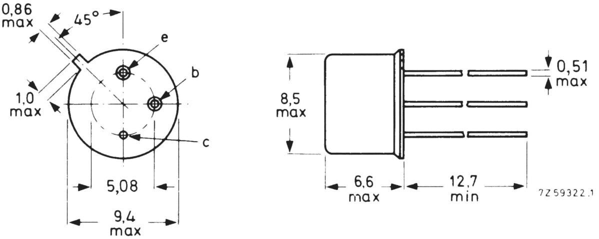
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40		V
Collector-emitter voltage (open base)	V_{CEO}	max.	25		V
Collector current (peak value; $f > 1$ MHz)	I_{CM}	max.	300		mA
Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	200		°C
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 15 V	C_{re}	typ.	1,7		pF
Transition frequency I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	f_T	typ.	1,2		GHz
			f = 200	800	MHz
Power gain (not neutralized) I_C = 70 mA; V_{CE} = 18 V	G_p	typ.	16	6,5	dB
Output power d_{im} = −30 dB; VSWR at output < 2; I_C = 70 mA; V_{CE} = 18 V	P_o	typ.	150	90	mW

MECHANICAL DATA

Dimensions in mm

Collector connected to case

Fig. 1 TO-39.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$) peak value	V_{CERM}	max.	40	V 1)
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V 1)
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V

Currents

Collector current (d.c.)	I_C	max.	150	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	300	mA

Power dissipation

Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1.5	W

Temperatures

Storage temperature	T_{stg}		-65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	250	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	50	°C/W
From mounting base to heatsink mounted with top clamping washer of 56218 and a boron nitride washer for electrical insulation	$R_{th\ mb-h}$	=	1.2	°C/W

---

1) I_C = 10 mA.

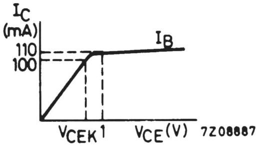
CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current

$I_E = 0$; $V_{CB} = 20$ V; $T_j = 150$ °C	I_{CBO}	<	20	μA

Knee voltage

$I_C = 100$ mA; I_B = value for which $I_C = 110$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain

$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 150$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	

Transition frequency

$I_C = 150$ mA; $V_{CE} = 15$ V; f = 500 MHz	f_T	typ.	1.2	GHz

Collector capacitance at f = 1 MHz

$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	<	4	pF

Feedback capacitance at f = 1 MHz

$I_C = 10$ mA; $V_{CE} = 15$ V; $T_{amb} = 25$ °C	$-C_{re}$	typ.	1.7	pF

Noise figure at f = 200 MHz

$I_C = 30$ mA; $V_{CE} = 15$ V; $R_S = 75\ \Omega$; $T_{amb} = 25$ °C	F	<	6	dB

Power gain (not neutralized)

		f = 200	800	MHz
$I_C = 70$ mA; $V_{CE} = 18$ V; $T_{amb} = 25$ °C	G_p	typ. 16	6.5	dB

CHARACTERISTICS (continued)

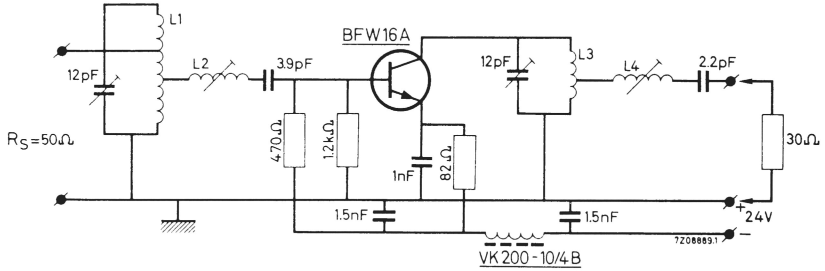
Intermodulation characteristics

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 70 mA; V_{CE} = 18 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9)

P_o	>	130	mW
	typ.	150	mW

Test circuit:


L1
BFW16A
L3
12pF
L2
3.9pF
12pF
L4
2.2pF
R_S=50Ω
470Ω
1.2kΩ
1nF
82Ω
30Ω
1.5nF
1.5nF
+
24V
−
7Z08889.1
VK200-10/4B

Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.

L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.

L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.

L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 220\ \Omega$; $C_L = -5.6$ pF.

C_{oe} is found by 4 pF of the transistor and 1.6 pF by the mounting system concerning of a borium nitride washer between the envelope of the transistor and the chassis. See also page 10, note 1.

Adjustment procedure

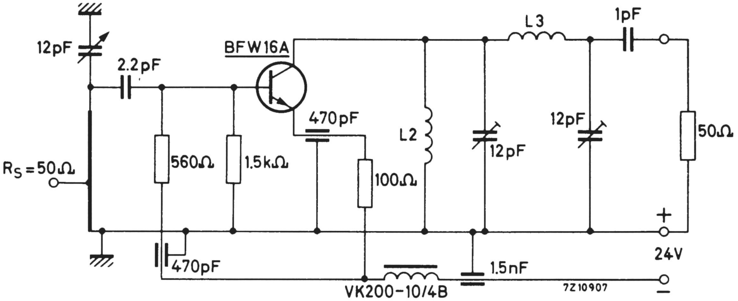
1. Remove the transistor and connect a dummy consisting of a 220 Ω resistor in parallel with a 5.6 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
Corrections can be made by tuning L2; this will not disturb the band pass curve.

CHARACTERISTICS (continued)

Intermodulation characteristics

2. Output power at f = 800 MHz; T_{amb} = 25 °C
I_C = 70 mA; V_{CE} = 18 V; V.S.W.R. at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) P_o > 70 mW, typ. 90 mW

Test circuit:



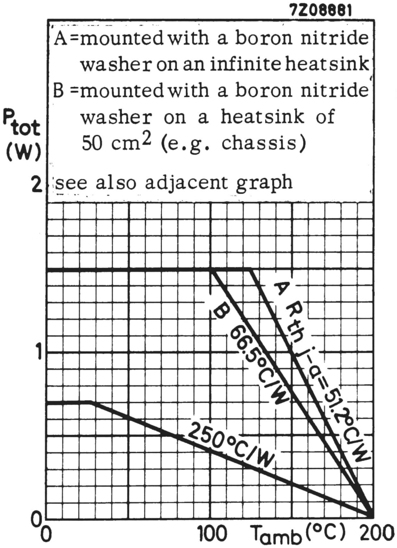
Coil data:
L1 = 25 mm x 7 mm x 0.85 mm silver plated Cu strip
Tap of the input at 5 mm from earth.
L2 = 13 turns enamelled Cu wire (0.6 mm); int. diam. 8 mm
L3 = 1.5 turns Cu wire (1.3 mm); int. diam. 8 mm

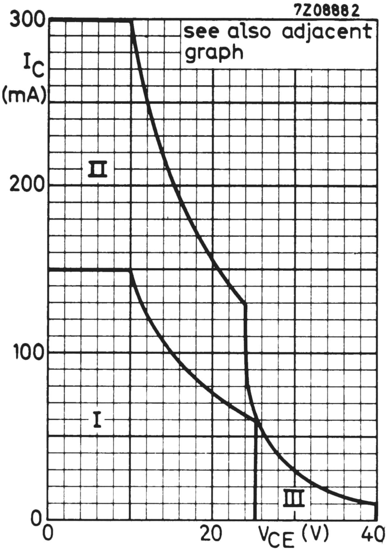
Basis of adjustment

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C(V_{CE} - V_{CEK})}{2} = 480\ \text{mW}.$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 480 mW.
With this adjusting method care must be taken, that the transistor is not destructed by second breakdown (the voltage swing may not exceed the rated V_{CER} value). Therefore as soon as clipping occurs, the increase of the input signal should be stopped until the clipping has been eliminated. After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve. The V.S.W.R. of the output is then ≤ 2 over the whole channel.

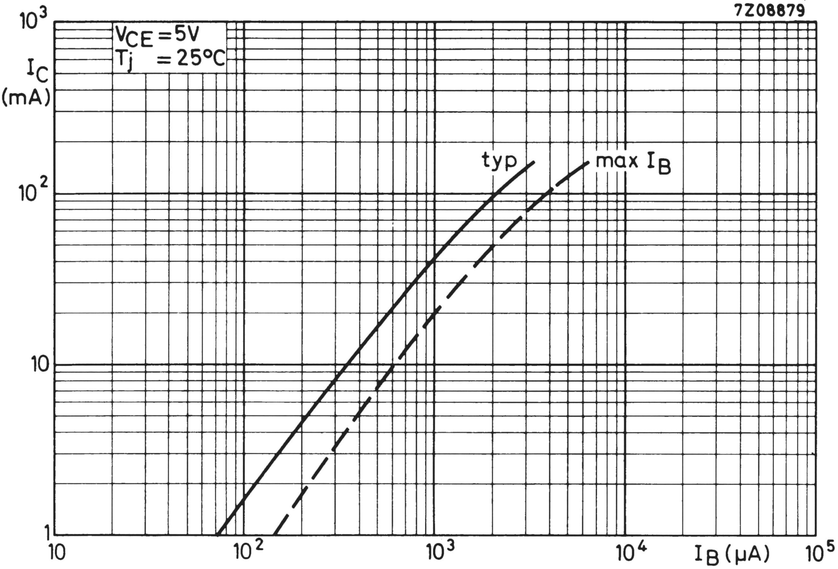




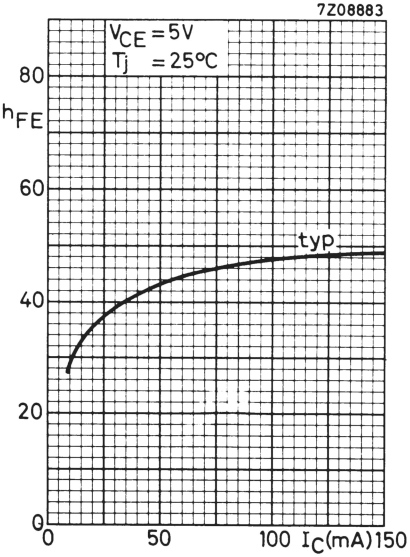
I = Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

II = Additional region of operation at f ≥ 1 MHz.

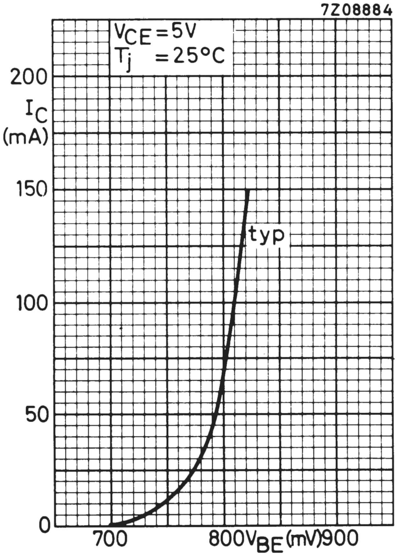
III = Operating under pulsed conditions is allowed, provided the transistor is cut-off with $R_{BE} \leq 50\ \Omega$ and f ≥ 1 MHz.



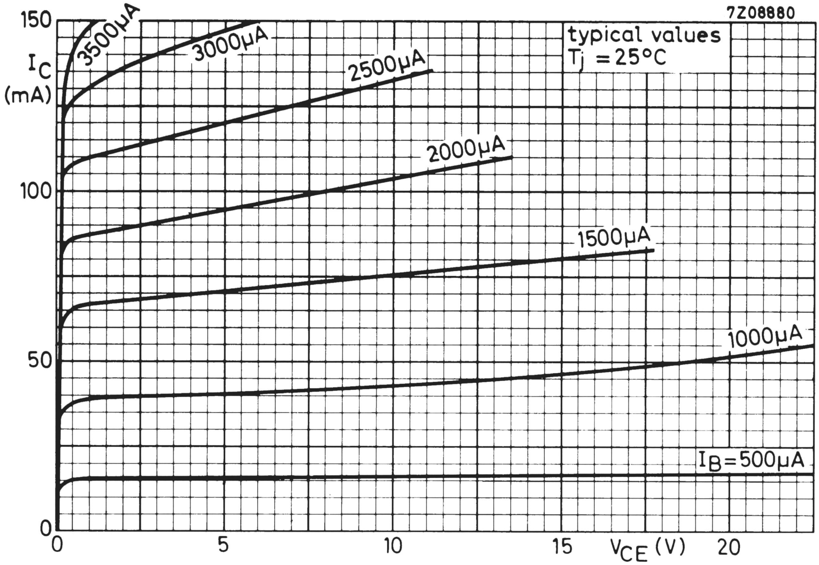
7Z08879
$V_{CE} = 5V$
$T_j = 25°C$
I_C (mA)
10^3
10^2
10
1
10
10^2
10^3
10^4
I_B (μA)
10^5
typ
max I_B

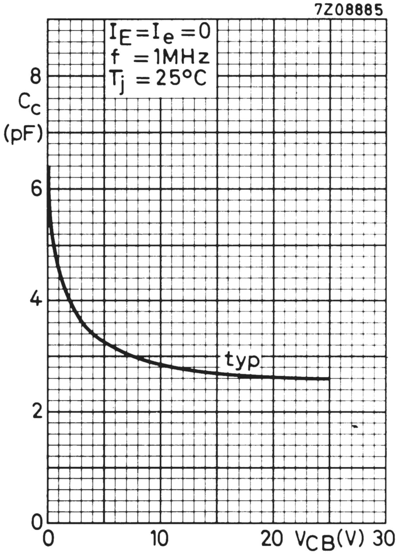


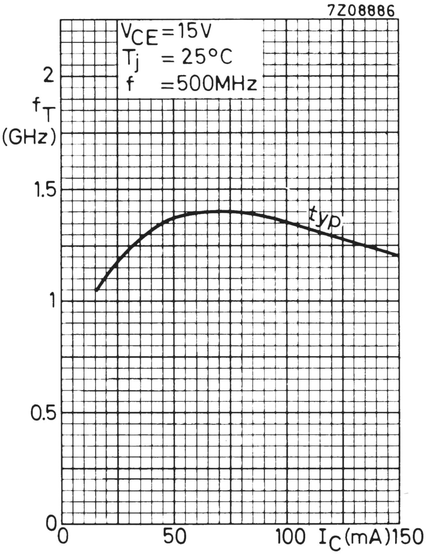
7Z08883
$V_{CE} = 5V$
$T_j = 25°C$
h_{FE}
80
60
40
20
0
0
50
100
I_C (mA)
150
typ



7Z08884
$V_{CE} = 5V$
$T_j = 25°C$
I_C (mA)
200
150
100
50
0
700
800
V_{BE} (mV)
900
typ


7Z08880
typical values
Tj = 25°C
I_C
(mA)
150
100
50
0
3500µA
3000µA
2500µA
2000µA
1500µA
1000µA
I_B=500µA
0
5
10
15
20
V_{CE} (V)


7Z08885
$I_E = I_e = 0$
f = 1MHz
Tj = 25°C
C_c
(pF)
8
6
4
2
0
typ
0
10
20
V_{CB}(V) 30


7Z08886
V_{CE} = 15V
Tj = 25°C
f = 500MHz
f_T
(GHz)
2
1.5
1
0.5
0
typ
0
50
100
I_C(mA)150

APPLICATION INFORMATION

Performance of channel- and band amplifiers 1)

Frequency range	channel 4 61-68	channel 9 202-209	channel 55 742-750	band I 47-68	band II 87.5-108	band III 174-230	MHz
Transistor used in							
final stage	BFW16A	BFW16A	BFW16A	BFW16A	BFW16A	BFW16A	
driver stage		BFW16A	BFW16A			BFW16A	
second stage			BFY90				
first stage	BFY90	BFY90	BFY90	BFY90	BFY90	BFY90	
Output power at							
$d_{im} = -30$ dB	150 2)	150 2)	100				mW
$d_{im} = -50$ dB					30		mW
$d_{im} = -60$ dB				10		10	mW
Power gain	50	44	26.5	51	43	39	dB
Noise figure	7	6	8	6.0-6.5	6.5	6.5	dB
V.S.W.R. over the whole channel or band							
for the input	< 2	< 2	< 2	< 2	< 2	< 2	
for the output	< 2	< 2	< 2	< 2	< 2	< 2	
Load impedance	30	30	50	30	30	30	Ω
Source impedance	60	60	50	60	60	60	Ω

---

1) Application information bulletins of all these amplifiers and a study of intermodulation are available on request.

2) $V_o = 2.2$ V over $R_L = 30\ \Omega$ or
$V_o = 3$ V over $R_L = 60\ \Omega$.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a TO-39 metal envelope, with the collector connected to the case. The transistor has extremely good intermodulation properties and a high power gain. It is a ruggedized version of the BFW17, which it succeeds. It is primarily intended for final and driver stages of channel and band aerial amplifiers with high output power for bands I, II and III (40–230 MHz).

QUICK REFERENCE DATA

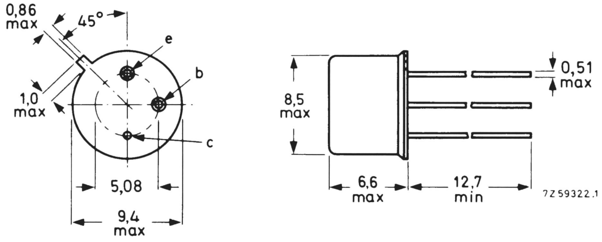
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V
Collector current (peak value; $f > 1$ MHz)	I_{CM}	max.	300	mA
Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1,5	W
Junction temperature	T_j	max.	200	°C
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 15 V	C_{re}	typ.	1,7	pF
Transition frequency I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	f_T	typ.	1,1	GHz
Power gain (not neutralized) I_C = 70 mA; V_{CE} = 18 V; f = 200 MHz	G_p	typ.	16	dB
Output power d_{im} = −30 dB; VSWR at output < 2; I_C = 70 mA; V_{CE} = 18 V	P_o	typ.	150	mW

MECHANICAL DATA

Dimensions in mm

Collector connected to case

Fig. 1 TO-39.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V	
Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$) peak value	V_{CERM}	max.	40	V	1)
Collector-emitter voltage (open base)	V_{CEO}	max.	25	V	1)
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V	

Currents

Collector current (d.c.)	I_C	max.	150	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	300	mA

Power dissipation

Total power dissipation up to T_{mb} = 125 °C	P_{tot}	max.	1.5	W

Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	250	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	50	°C/W
From mounting base to heatsink mounted with top clamping washer of 56218 and a boron nitride washer for electrical insulation	$R_{th\ mb\text{-}h}$	=	1.2	°C/W

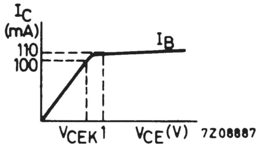
---

1) I_C = 10 mA.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 150$ °C	I_{CBO}	<	20	μA
Knee voltage				
$I_C = 100$ mA; I_B = value for which $I_C = 110$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain				
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 150$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
Transition frequency				
$I_C = 150$ mA; $V_{CE} = 15$ V; f = 500 MHz	f_T	typ.	1.1	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	<	4	pF
Feedback capacitance at f = 1 MHz				
$I_C = 10$ mA; $V_{CE} = 15$ V; $T_{amb} = 25$ °C	$-C_{re}$	typ.	1.7	pF
Power gain (not neutralized)				
$I_C = 70$ mA; $V_{CE} = 18$ V f = 200 MHz; $T_{amb} = 25$ °C	G_p	typ.	16	dB

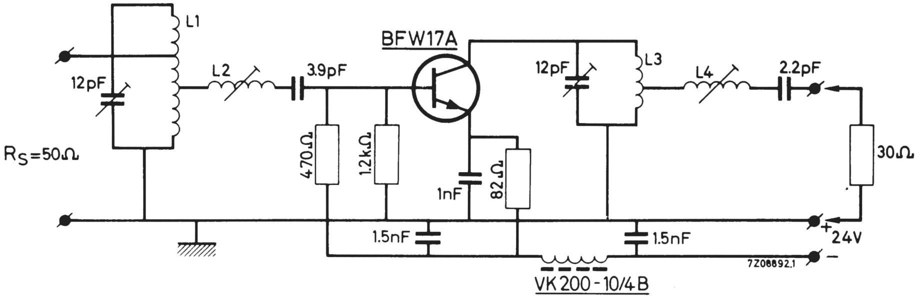
CHARACTERISTICS (continued)

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{amb} = 25 °C

   I_C = 70 mA; V_{CE} = 18 V; V.S.W.R. at output < 2
   f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) P_o typ. 150 mW

   Test circuit:


L1
12pF
L2
3.9pF
BFW17A
12pF
L3
L4
2.2pF
R_S=50Ω
470Ω
1.2kΩ
1nF
82Ω
30Ω
1.5nF
1.5nF
+
24V
−
VK200-10/4B
7Z08892.1

Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C}$$

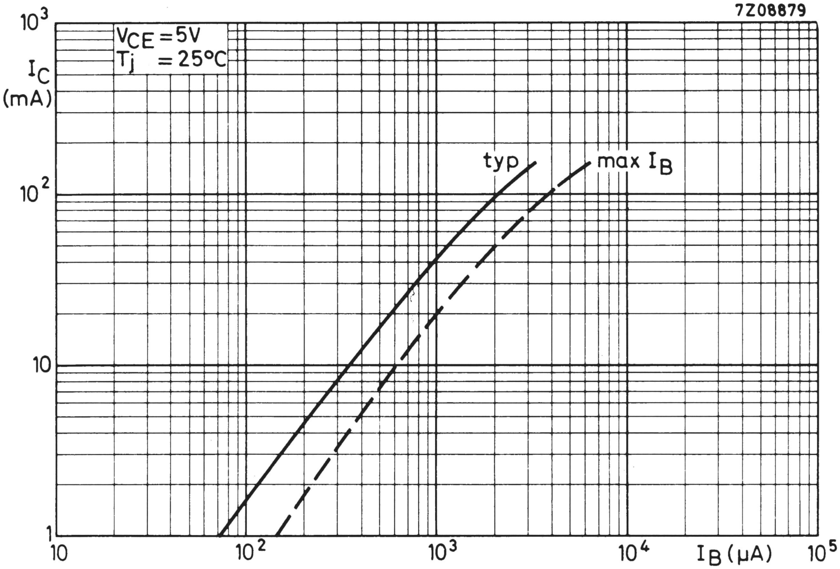
in which V_{CEK} is the high frequency knee voltage.

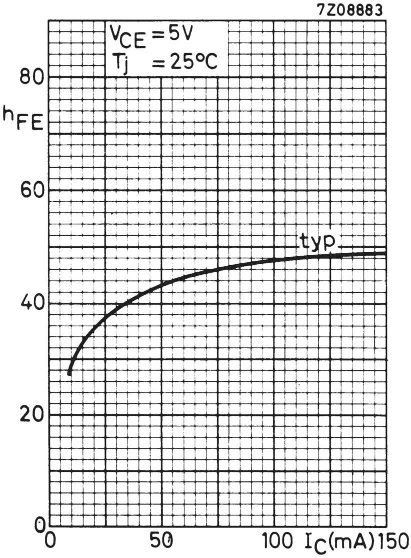
b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

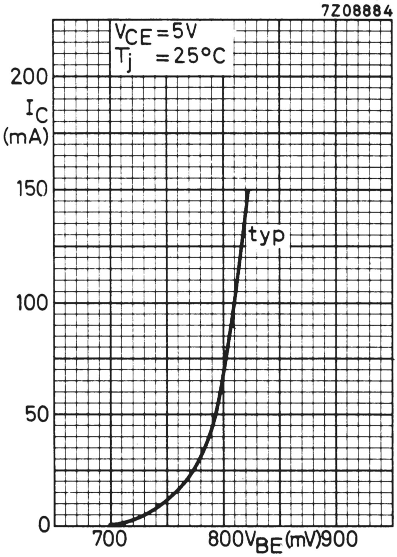
For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 220\ \Omega$; $C_L = -5.6$ pF.
C_{oe} is found by 4 pF of the transistor and 1.6 pF by the mounting system concerning of a borium nitride washer between the envelope of the transistor and the chassis.

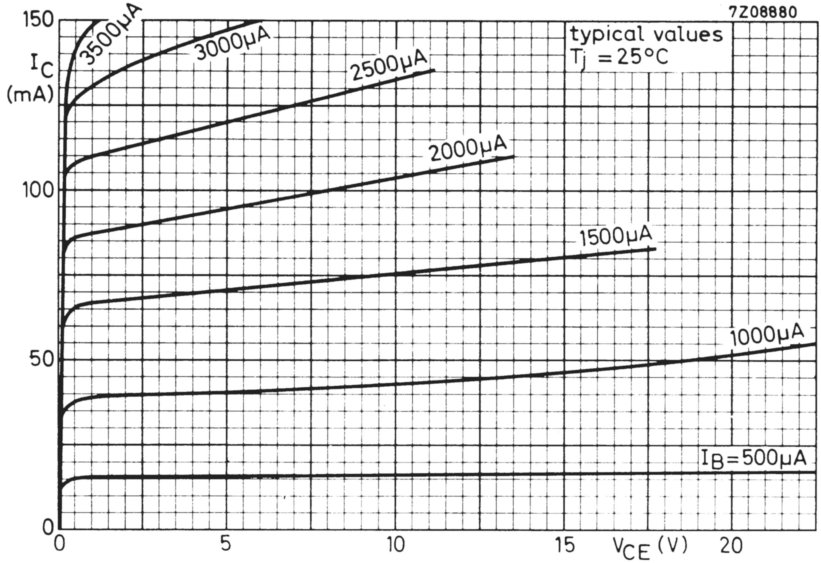
Adjustment procedure

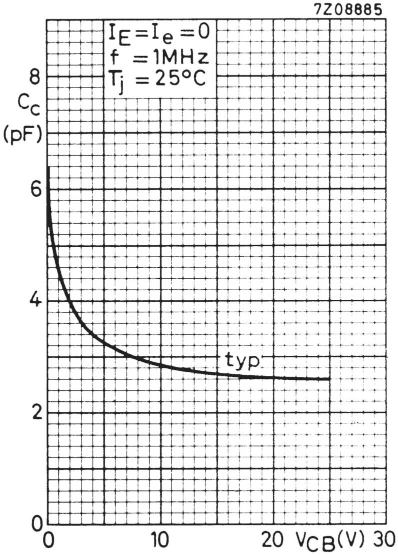
1. Remove the transistor and connect a dummy consisting of a 220 Ω resistor in parallel with a 5.6 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
Corrections can be made by tuning L2; this will not disturb the band pass curve.

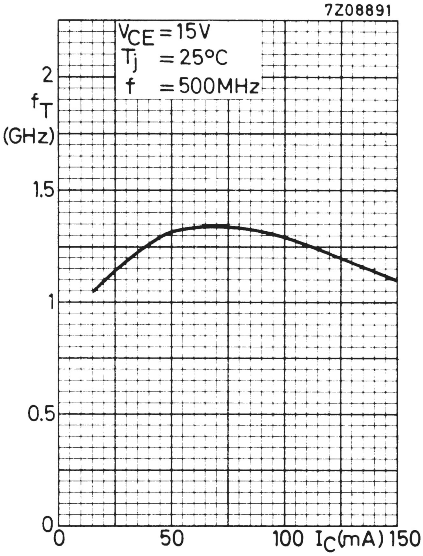

7Z08879
V_{CE} = 5V
T_j = 25°C
I_C (mA)
10^3
10^2
10
1
typ
max I_B
10
10^2
10^3
10^4
I_B (μA)
10^5

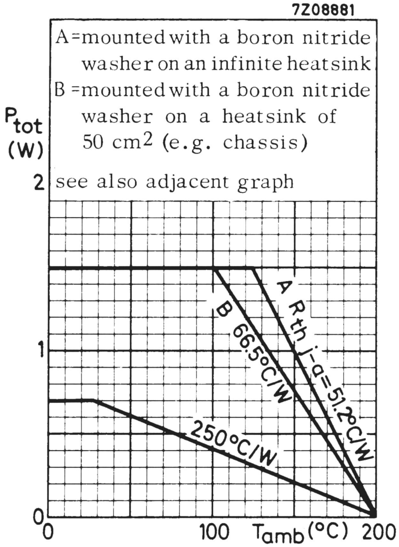

7Z08883
V_{CE} = 5V
T_j = 25°C
h_{FE}
80
60
40
20
0
typ
0
50
100
I_C (mA)
150

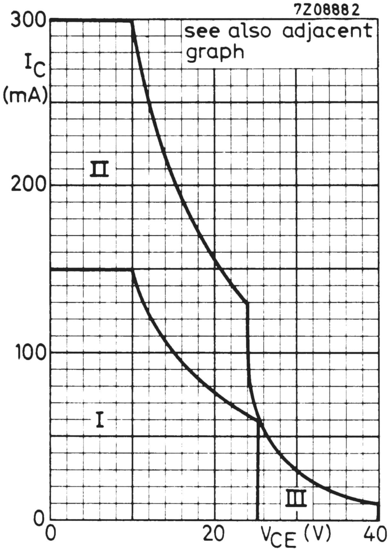

7Z08884
V_{CE} = 5V
T_j = 25°C
I_C (mA)
200
150
100
50
0
typ
700
800
V_{BE} (mV)
900


7Z08880
typical values
T_j = 25°C
150
I_C
(mA)
100
50
0
0
5
10
15
V_{CE} (V)
20
3500μA
3000μA
2500μA
2000μA
1500μA
1000μA
I_B=500μA


7Z08885
$I_E = I_e = 0$
f = 1MHz
T_j = 25°C
8
C_c
(pF)
6
4
2
0
0
10
20
V_{CB}(V)
30
typ


7Z08891
V_{CE} = 15V
T_j = 25°C
f = 500MHz
2
f_T
(GHz)
1.5
1
0.5
0
0
50
100
I_C(mA)
150





I = Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

II = Additional region of operation at f ≥ 1 MHz

III = Operating under pulsed conditions is allowed, provided the transistor is cut-off with $R_{BE} \leq 50\ \Omega$ and f ≥ 1 MHz.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter transistor in a TO-72 metal envelope, with insulated electrodes and a shield lead connected to the case. The transistor has very low intermodulation distortion and very high power gain. It is primarily intended for:

- Wideband vertical amplifiers in high speed oscilloscopes.
- Wideband aerial amplifiers (40—860 MHz).
- Television distribution amplifiers.

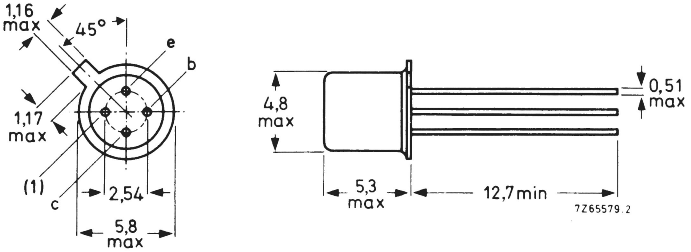
QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	20		V
Collector-emitter voltage (open base)	V_{CEO}	max.	10		V
Collector current (peak value; $f > 1$ MHz)	I_{CM}	max.	100		mA
Total power dissipation up to $T_{amb} = 25\ ^{o}C$	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	200		^{o}C
Feedback capacitance at f = 1 MHz $I_C = 2$ mA; $V_{CE} = 5$ V	C_{re}	typ.	0,8		pF
Transition frequency $I_C = 50$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	1,6		GHz
Power gain (not neutralized)			f = 200	800	MHz
$I_C = 30$ mA; $V_{CE} = 5$ V	G_p	typ.	21	7,5	dB
Intermodulation distortion $I_C = 30$ mA; $V_{CE} = 6$ V; $R_L = 37,5\ \Omega$; $V_o = 100$ mV at $f_p = 183$ MHz; $V_o = 100$ mV at $f_q = 200$ MHz; measured at $f_{(2q-p)} = 217$ MHz	d_{im}	typ.	−60		dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages					
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	20	V	
Collector-emitter voltage (open base)					
I_C = 10 mA	V_{CEO}	max.	10	V	2)
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V	
Currents					
Collector current (d.c.)	I_C	max.	50	mA	
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA	
Power dissipation					
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW	
Temperatures					
Storage temperature	T_{stg}		-65 to +200	°C	
Junction temperature	T_j	max.	200	°C	

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	0.7	°C/mW
From junction to case	$R_{th\ j-c}$	=	0.5	°C/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50	nA
D.C. current gain				
$I_C = 25$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
Transition frequency [1]				
$I_C = 50$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	1.6	GHz
Collector capacitance at f = 1 MHz [2]				
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	<	1.5	pF
Feedback capacitance at f = 1 MHz [1]				
$I_C = 2$ mA; $V_{CE} = 5$ V	$-C_{re}$	typ.	0.8	pF
Noise figure [1]				
$I_C = 2$ mA; $V_{CE} = 5$ V f = 500 MHz; $R_S = 50\ \Omega$	F	<	5	dB

Power gain (not neutralized) [1]

$I_C = 30$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C

		f = 200	800	MHz
G_p	>	19		dB
	typ.	21	7.5	dB

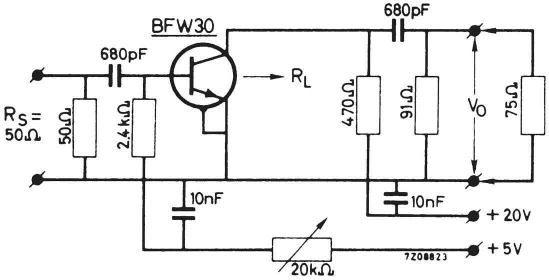
Intermodulation distortion [1]

$I_C = 30$ mA; $V_{CE} = 6$ V; $R_L = 37.5\ \Omega$; $T_{amb} = 25$ °C

$V_o = 100$ mV at $f_p = 183$ MHz

$V_o = 100$ mV at $f_q = 200$ MHz
measured at $f_{(2q-p)} = 217$ MHz d_{im} typ. −60 dB

Test circuit



BFW30
680pF
680pF
R_L
R_S = 50Ω
50Ω
2.4kΩ
470Ω
91Ω
V_o
75Ω
10nF
10nF
+20V
+5V
20kΩ
7Z08823

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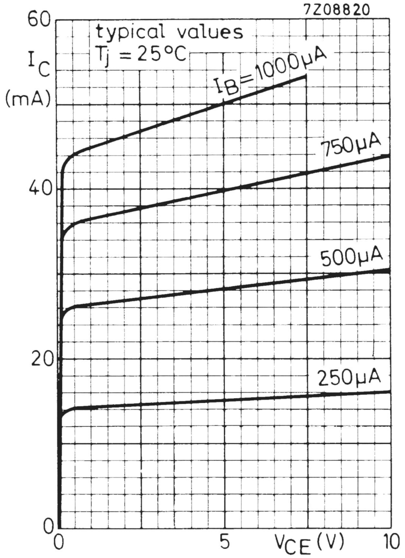
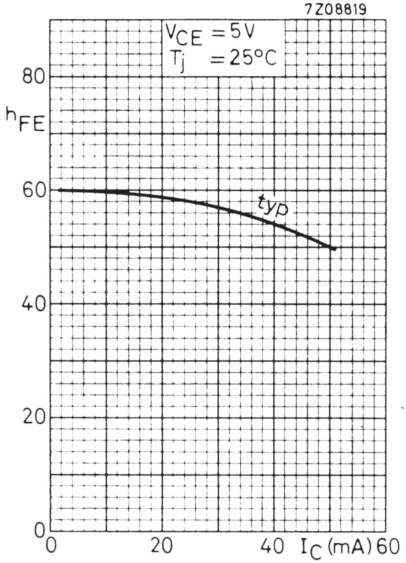
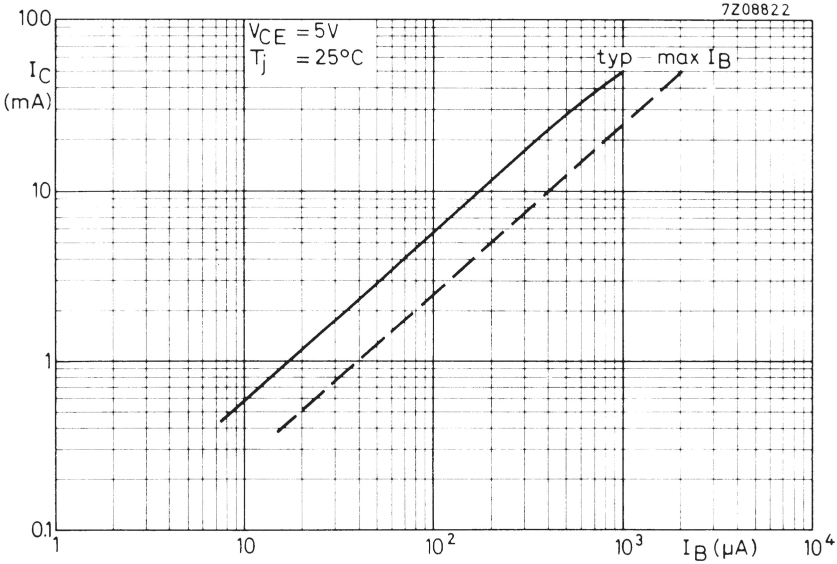
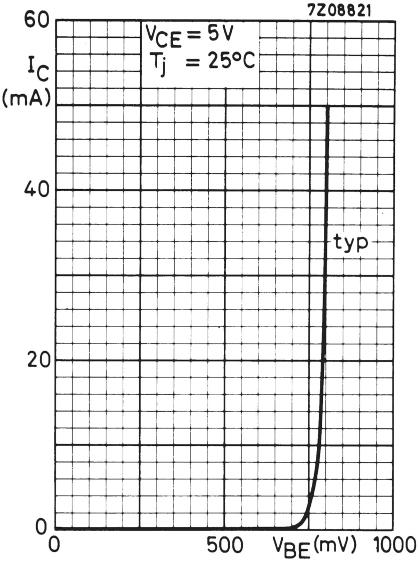
[1] Shield lead grounded.

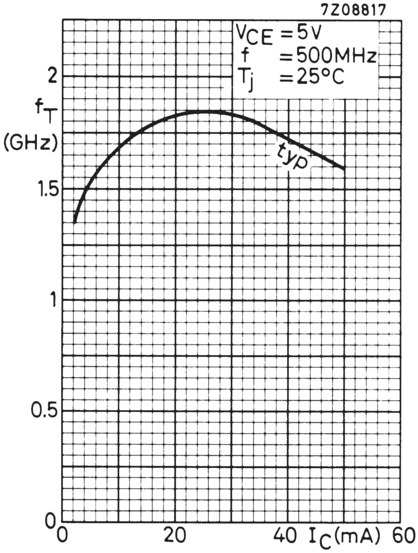
[2] Shield lead not connected.

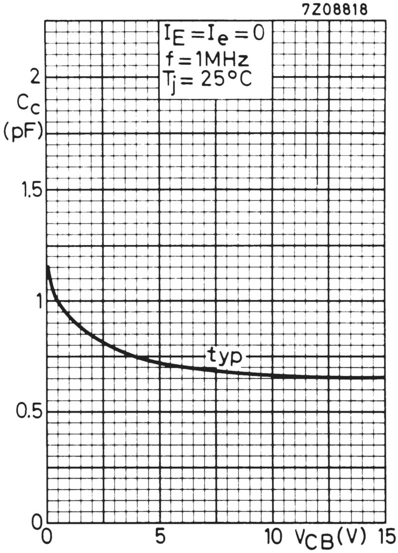

7Z08820
typical values
Tj = 25°C
60
I_C
(mA)
40
20
0
I_B = 1000 μA
750 μA
500 μA
250 μA
0
5
V_CE (V)
10


7Z08819
V_CE = 5 V
Tj = 25°C
80
h_FE
60
40
20
0
typ
0
20
40
I_C (mA)
60


7Z08822
V_CE = 5 V
Tj = 25°C
100
I_C
(mA)
10
1
0.1
typ
max I_B
1
10
10^2
10^3
I_B (μA)
10^4


7Z08821
$V_{CE} = 5\,V$
$T_j = 25°C$
I_C (mA)
60
40
20
0
typ
0
500
V_{BE} (mV)
1000


7Z08817
$V_{CE} = 5\,V$
$f = 500\,MHz$
$T_j = 25°C$
f_T (GHz)
2
1.5
1
0.5
0
typ
0
20
40
I_C (mA)
60


7Z08818
$I_E = I_e = 0$
$f = 1\,MHz$
$T_j = 25°C$
C_c (pF)
2
1.5
1
0.5
0
typ
0
5
10
V_{CB} (V)
15

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic T-package. It has a low noise over a wide current range, a very high power gain and good intermodulation properties.
It is primarily intended for:

- Wideband aerial amplifiers (40 - 860 MHz)
- Channel and band aerial amplifiers for band I, II, III and IV/V (40 - 860 MHz)
- Television distribution amplifiers
- Low noise wideband vertical amplifier in high speed oscilloscopes

QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	25		V
Collector-emitter voltage (open base)	V_{CEO}	max.	15		V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50		mA
Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 500 MHz I_C = 25 mA; V_{CE} = 5 V	f_T	typ.	1,6		GHz
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V	C_{re}	typ.	0,6		pF
Noise figure at f = 500 MHz I_C = 2 mA; V_{CE} = 5 V	F	typ.	4		dB
		f =	200	800	MHz
Power gain (not neutralized) I_C = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C	G_p	typ.	23	11	dB
Output power at d_{im} = −30 dB VSWR at output < 2; I_C = 10 mA; V_{CE} = 10 V	P_o	typ.	8	8	mW

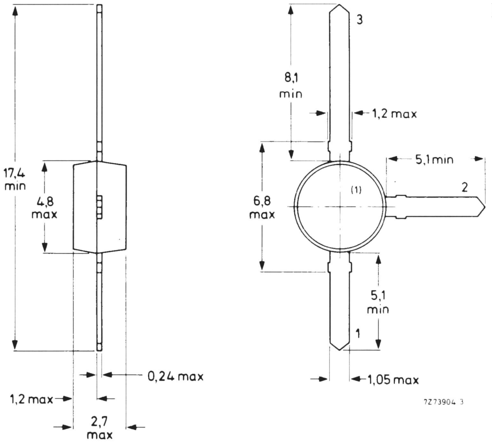
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

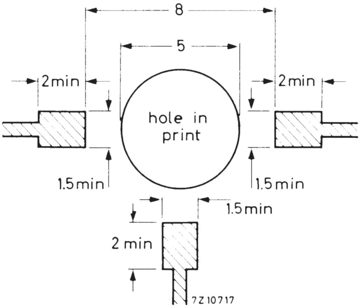
Voltages				
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V [1]
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V
Currents				
Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50	mA
Power dissipation				
Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190	mW
Temperatures				
Storage temperature	T_{stg}	-65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a glass-fibre print *) of 40 mm x 25 mm x 1 mm $R_{th\ j-a}$ = 0.4 °C/mW

*) Requirements for glass-fibre print

(dimensions in mm)



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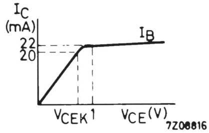
[1] At I_C = 10 mA

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50	nA
Knee voltage [1]				
$I_C = 20$ mA; I_B = value for which $I_C = 22$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain				
$I_C = 2$ mA; $V_{CE} = 1$ V	h_{FE}	> <	20 150	
$I_C = 25$ mA; $V_{CE} = 1$ V [1]	h_{FE}	>	20	
Transition frequency at f = 500 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V	f_T	typ.	1.0	GHz
$I_C = 25$ mA; $V_{CE} = 5$ V [1]	f_T	typ.	1.6	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	0.7	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	typ.	1.5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	$-C_{re}$	typ.	0.6	pF
Noise figure at f = 500 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $R_S = 50\,\Omega$; $T_{amb} = 25$ °C	F	typ.	4.0	dB

			f = 200	800	MHz
Power gain (not neutralized)					
$I_C = 10$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	G_p	typ.	23	11	dB

---

[1] Measured under pulsed conditions.

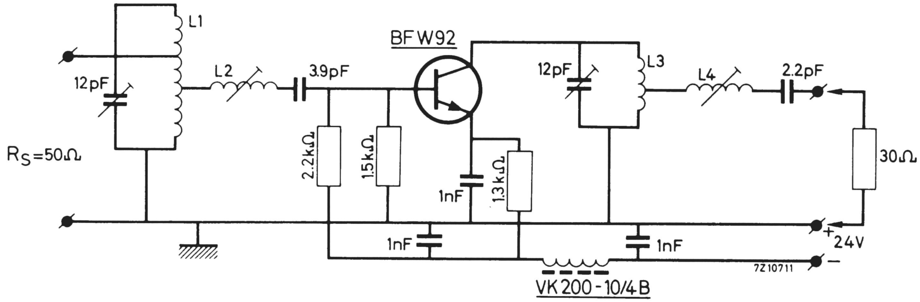
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics

1. Output power at f = 200 MHz; T_{amb} = 25 °C

   I_C = 10 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
   f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
   measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) P_o typ. 8 mW

Test circuit:


L1
12pF
L2
3.9pF
BFW92
2.2kΩ
1.5kΩ
1nF
1.3kΩ
12pF
L3
L4
2.2pF
30Ω
R_S=50Ω
1nF
1nF
+
24V
−
7Z10711
VK200-10/4B

Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm;
int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm;
int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm;
int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm;
int. diam. 11 mm.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C}.$$

in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
R_L = 820 Ω; C_L = −1.0 pF

Adjustment procedure

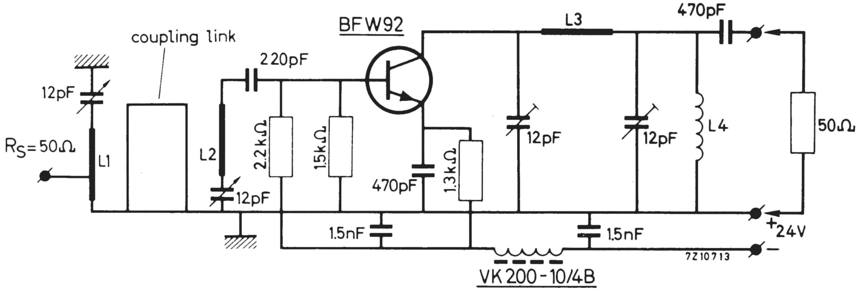
1. Remove the transistor and connect a dummy consisting of a 820 Ω resistor in parallel with a 1.0 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
Corrections can be made by tuning L2; this will not disturb the band pass curve.

CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics

2. Output power at f = 800 MHz; T_{amb} = 25 °C

I_C = 10 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) P_o typ. 8 mW



Coil data:
L1 = 24 mm x 6 mm x 0.5 mm silver plated Cu strip.
Tap of the input at 5 mm from earth.
L2 = 15 mm x 6 mm x 0.5 mm silver plated Cu strip.
L3 = 20 mm x 8 mm x 0.5 mm silver plated Cu strip.
L4 = 4 turns enamelled Cu wire (0.5mm); winding pitch 1.5mm; int. diam. 4mm
Coupling link: 42 mm silver plated Cu wire (1 mm).

Basis of adjustment.

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C\,(V_{CE} - V_{CEK})}{2} = 40\ \text{mW}$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 40 mW.
After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output is then ≤ 2 over the whole channel.

CHARACTERISTICS (continued)

Intermodulation characteristics

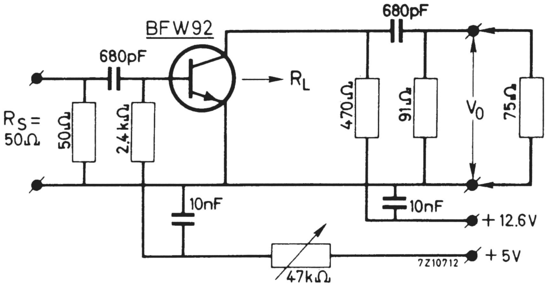
3. Intermodulation distortion

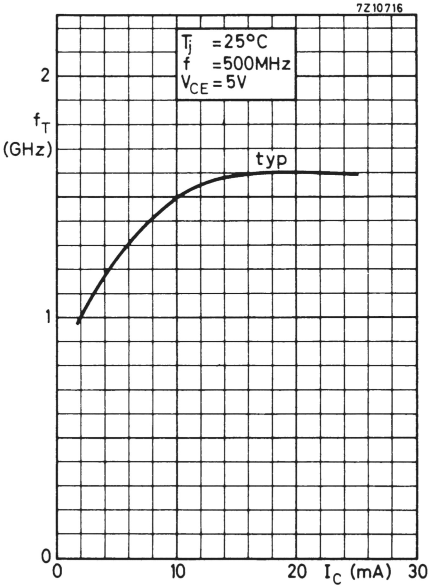
I_C = 10 mA; V_{CE} = 6 V: R_L = 37.5 Ω: T_{amb} = 25 °C

V_0 = 100 mV at f_p = 183 MHz

V_0 = 100 mV at f_q = 200 MHz
measured at $f_{(2q-p)}$ = 217 MHz d_{im} typ. −45 dB

Test circuit:


BFW92
680pF
680pF
R_S =
50Ω
50Ω
2.4kΩ
R_L
470Ω
91Ω
V_0
75Ω
10nF
10nF
+ 12.6V
+ 5V
47kΩ
7Z10712


7Z10716
T_j = 25°C
f = 500MHz
V_{CE} = 5V
f_T
(GHz)
2
1
0
typ
0
10
20
I_C (mA)
30

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfer-moulded T-package.
The device is intended for use in v.h.f. - u.h.f. applications, primarily wideband aerial amplifiers 40 - 800 MHz.
It is intended for mounting on miniature printed-circuit boards.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	18	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA
Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190	mW
Junction temperature	T_j	max.	150	°C
Feedback capacitance at f = 1 MHz				
I_C = 2 mA; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,6	pF
Transition frequency at f = 500 MHz				
I_C = 50 mA; V_{CE} = 5 V	f_T	typ.	1,7	GHz
Max. unilateral power gain (see page 3)				
I_C = 30 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	G_{UM}	typ.	22	dB
I_C = 30 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	G_{UM}	typ.	10,5	dB
Intermodulation distortion at T_{amb} = 25 °C				
I_C = 30 mA; V_{CE} = 5 V; R_L = 37,5 Ω				
V_O = 100 mV at f_p = 183 MHz				
V_O = 100 mV at f_q = 200 MHz				
measured at $f_{(2q-p)}$ = 217 MHz	d_{im}	typ.	−60	dB

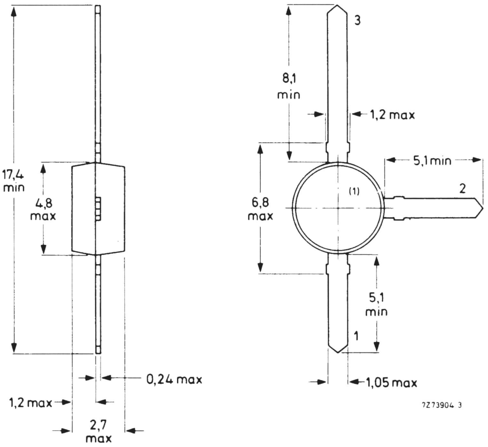
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-37.

Connections

1. Base
2. Emitter
3. Collector



(1) = type number marking.

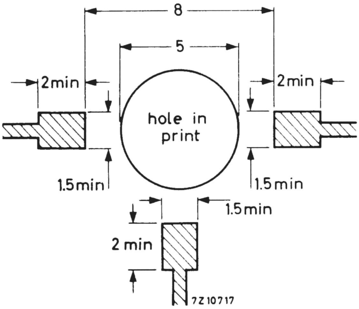
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages				
Collector-base voltage (open emitter)	V_{CBO}	max.	18	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V
Currents				
Collector current (d.c.)	I_C	max.	50	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	100	mA
Power dissipation				
Total power dissipation up to T_{amb} = 73 °C	P_{tot}	max.	190	mW
Temperatures				
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a glass-fibre print of 40 mm x 25 mm x 1 mm	$R_{th\ j\text{-}a}$	=	0.4	°C/mW

Requirements for glass-fibre print
(dimensions in mm)



CHARACTERISTICS

$T_j = 25\ ^{o}C$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	<	50	nA
D.C. current gain [1]				
$I_C = 25$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}	>	25	
Transition frequency at f = 500 MHz [1]				
$I_C = 50$ mA; $V_{CE} = 5$ V	f_T	typ.	1.7	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0.7	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	typ.	1.5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25\ ^{o}C$	$-C_{re}$	typ.	0.6	pF
Noise figure at f = 500 MHz				
$I_C = 2$ mA; $V_{CE} = 5$ V; $G_S = 20$ mA/V				
B_S is tuned; $T_{amb} = 25\ ^{o}C$	F	<	5	dB

→ Max. unilateral power gain (s_{re} assumed to be zero)

$$G_{UM}\ (\text{in dB}) = 10 \log \frac{|s_{fe}|^2}{(1 - |s_{ie}|^2)(1 - |s_{oe}|^2)}$$

$I_C = 30$ mA; $V_{CE} = 5$ V; f = 200 MHz; $T_{amb} = 25\ ^{o}C$	G_{UM}	typ.	22	dB
$I_C = 30$ mA; $V_{CE} = 5$ V; f = 800 MHz; $T_{amb} = 25\ ^{o}C$	G_{UM}	typ.	10.5	dB

---

[1] Measured under pulse conditions.

CHARACTERISTICS (continued)

Intermodulation distortion at $T_{amb} = 25\ ^{o}C$

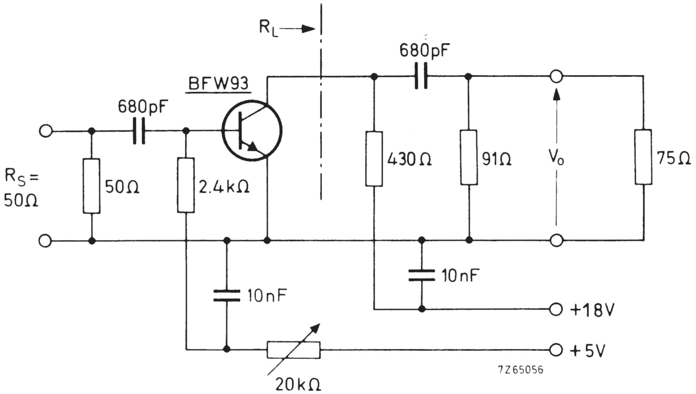
$I_C = 30$ mA; $V_{CE} = 5$ V; $R_L = 37.5\ \Omega$

$V_o = 100$ mV at $f_p = 183$ MHz

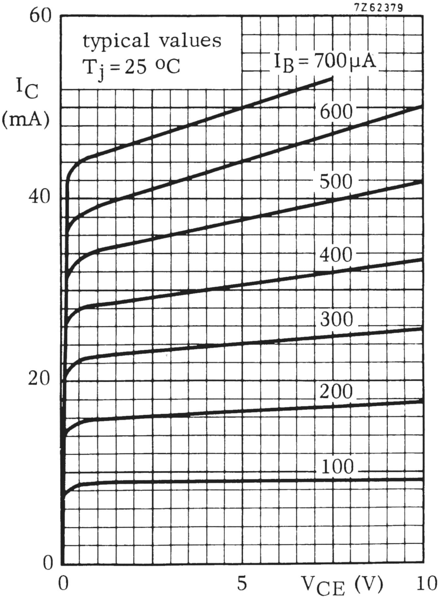
$V_o = 100$ mV at $f_q = 200$ MHz

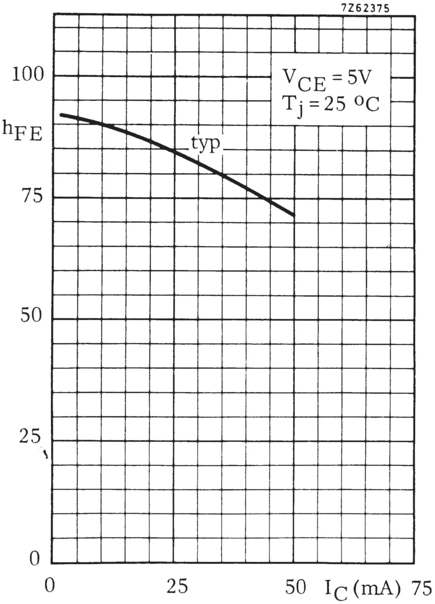
measured at $f_{(2q-p)} = 217$ MHz $\qquad d_{im} \quad$ typ. $\quad -60 \quad$ dB

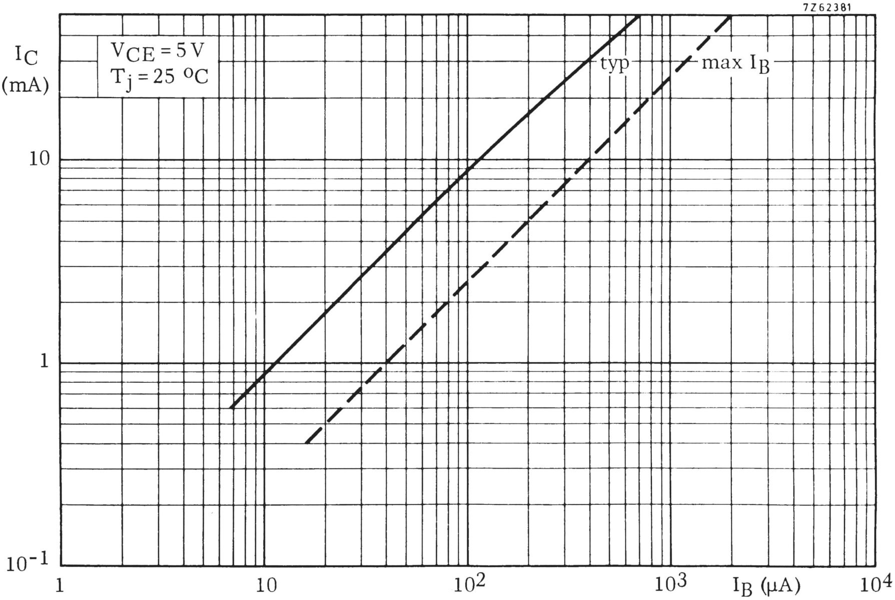
Test circuit:

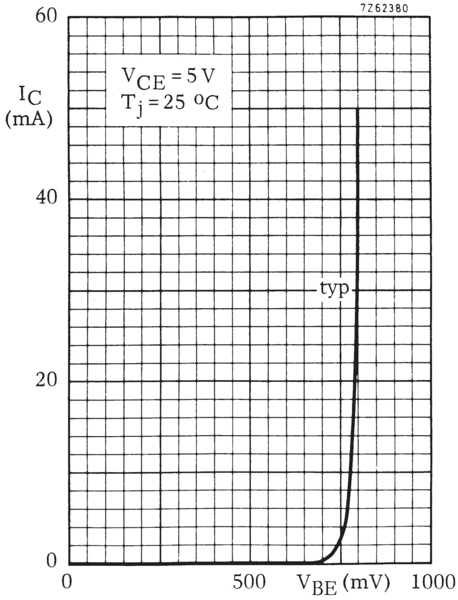


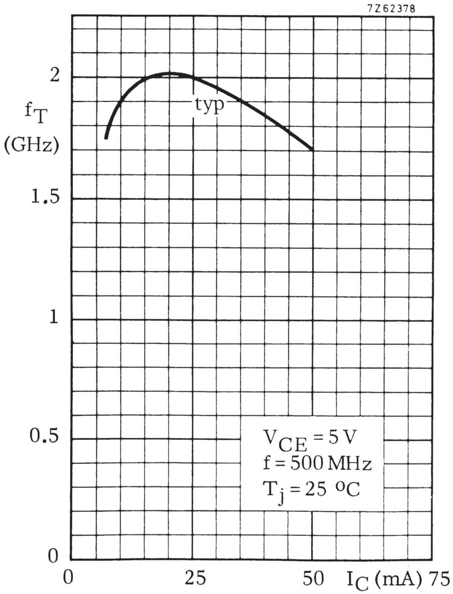
R_L
680pF
BFW93
680pF
R_S = 50Ω
50Ω
2.4kΩ
430Ω
91Ω
V_o
75Ω
10nF
10nF
+18V
+5V
20kΩ
7Z65056

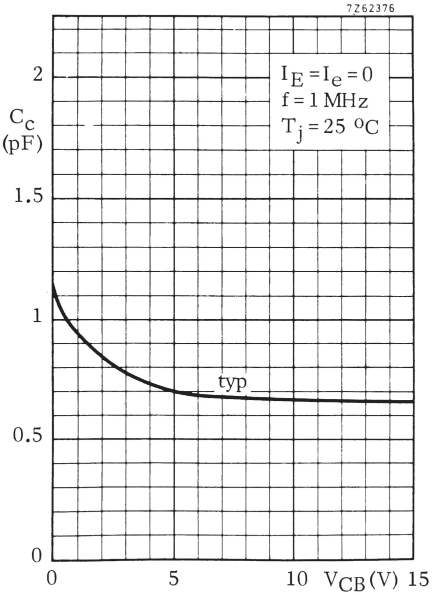

7Z62379
typical values
Tj = 25 °C
IC (mA)
IB = 700 µA
600
500
400
300
200
100
60
40
20
0
0
5
VCE (V)
10


7Z62375
VCE = 5V
Tj = 25 °C
hFE
typ
100
75
50
25
0
0
25
50
IC (mA)
75

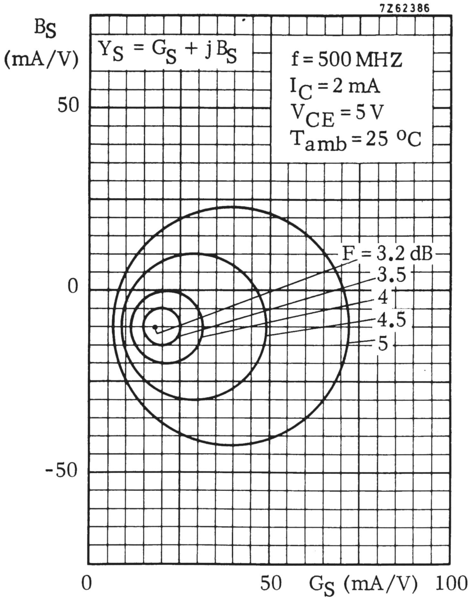

7Z62381
VCE = 5 V
Tj = 25 °C
IC (mA)
typ
max IB
10
1
10−1
1
10
10²
10³
IB (µA)
10⁴

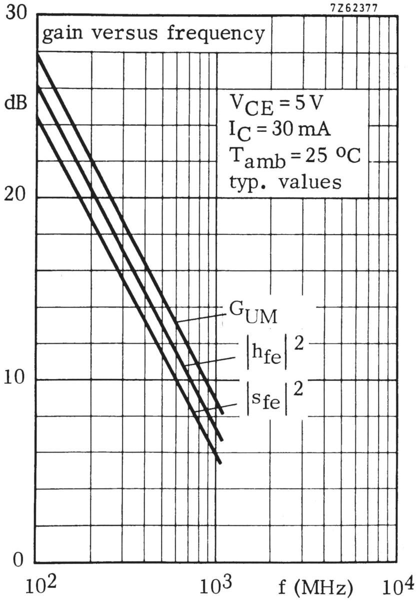

7Z62380
I_C (mA)
60
40
20
0
V_{CE} = 5 V
T_j = 25 °C
typ
0
500
V_{BE} (mV)
1000

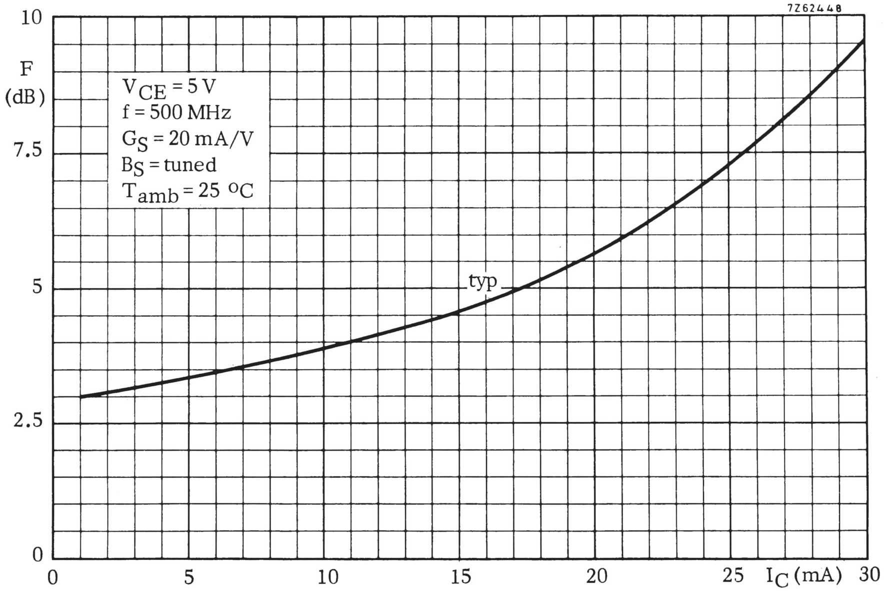

7Z62378
f_T (GHz)
2
1.5
1
0.5
0
typ
V_{CE} = 5 V
f = 500 MHz
T_j = 25 °C
0
25
50
I_C (mA) 75


7Z62376
C_c (pF)
2
1.5
1
0.5
0
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
typ
0
5
10
V_{CB} (V) 15

circles of constant noise figure



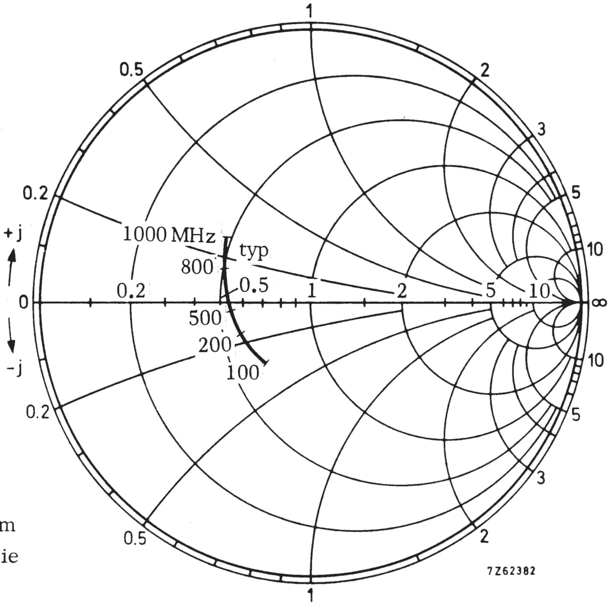




V_{CE} = 5 V

I_C = 30 mA

T_{amb} = 25 °C

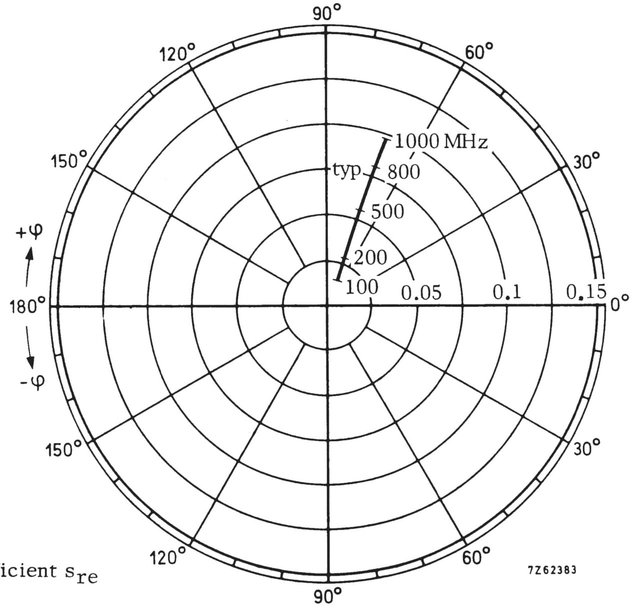


Input impedance derived from input reflection coefficient s_{ie} coordinates in ohm x 50

V_{CE} = 5 V

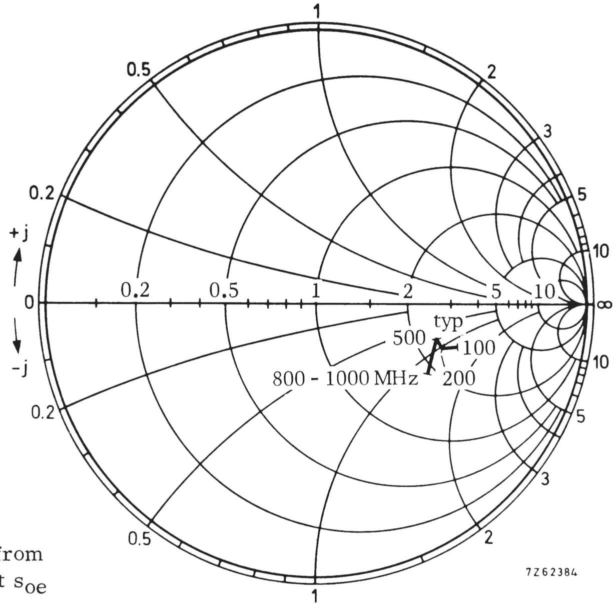
I_C = 30 mA

T_{amb} = 25 °C



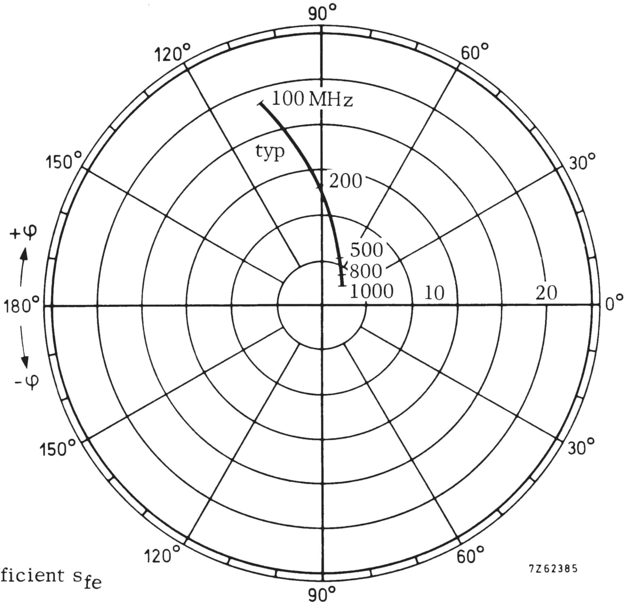
Reverse transmission coefficient s_{re}

V_{CE} = 5 V
I_C = 30 mA
T_{amb} = 25 °C



Output impedance derived from output reflection coefficient s_{oe} coordinates in ohm x 50

V_{CE} = 5 V
I_C = 30 mA
T_{amb} = 25 °C



Forward transmission coefficient s_{fe}

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope, with insulated electrodes and a shield lead connected to the case. The transistor has a low noise, a very high power gain and good intermodulation properties. It is primarily intended for:

- Channel aerial amplifiers for bands I, II, III and IV/V (40–860 MHz).
- Wideband aerial amplifiers (40–860 MHz).

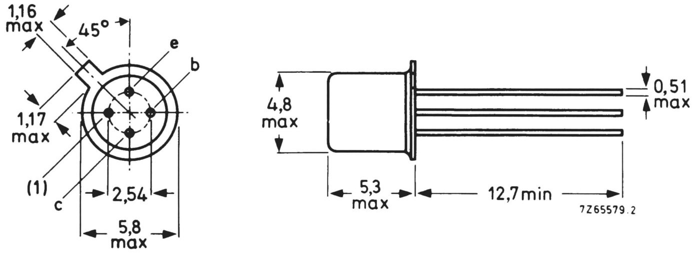
QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.		30	V
Collector-emitter voltage (open base)	V_{CEO}	max.		15	V
Collector current (peak value; $f > 1$ MHz)	I_{CM}	max.		50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		200	mW
Junction temperature	T_j	max.		200	°C
Transition frequency I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.		1,2	GHz
Feedback capacitance I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz	C_{re}	typ.		0,6	pF
			f = 200	800	MHz
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V	F	typ.	3,3	7	dB
Power gain (not neutralized) I_C = 8 mA; V_{CE} = 10 V	G_p	typ.	22	7	dB
Output power d_{im} = −30 dB; VSWR at output < 2; I_C = 8 mA; V_{CE} = 10 V	P_o	typ.	6	6	mW

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	30	V
Collector-emitter voltage (peak value) $R_{BE} \leq 50\ \Omega$	V_{CERM}	max.	30	V [1]
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V [1]
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V

Currents

Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value; f > 1 MHz)	I_{CM}	max.	50	mA

Power dissipation

Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	200	mW

Temperatures

Storage temperature	T_{stg}		-65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

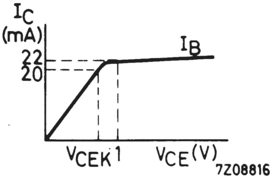
From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0.88	°C/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0.58	°C/mW

---

[1] $I_C = 10$ mA.

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	10	nA
Knee voltage				
$I_C = 20$ mA; I_B = value for which $I_C = 22$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain				
$I_C = 2$ mA; $V_{CE} = 1$ V	h_{FE}		20 to 150	
$I_C = 25$ mA; $V_{CE} = 1$ V	h_{FE}		20 to 125	
Transition frequency 1)				
$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	1.0	GHz
$I_C = 25$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	typ.	1.2	GHz
Collector capacitance at f = 1 MHz 2)				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	<	1.7	pF
Feedback capacitance at f = 1 MHz 1)				
$I_C = 2$ mA; $V_{CE} = 5$ V	$-C_{re}$	typ.	0.6	pF
Noise figure 1)				
$I_C = 2$ mA; $V_{CE} = 5$ V				
f = 200 MHz; optimum source impedance	F	<	4	dB
f = 500 MHz; $R_S = 50\ \Omega$	F	<	6.5	dB
f = 800 MHz; optimum source impedance	F	typ.	7.0	dB

Power gain (not neutralized) 1)

			f = 200	800	MHz
$I_C = 8$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	G_p	>	19	–	dB
		typ.	22	7	dB

---

1) Shield lead grounded.
2) Shield lead not connected.

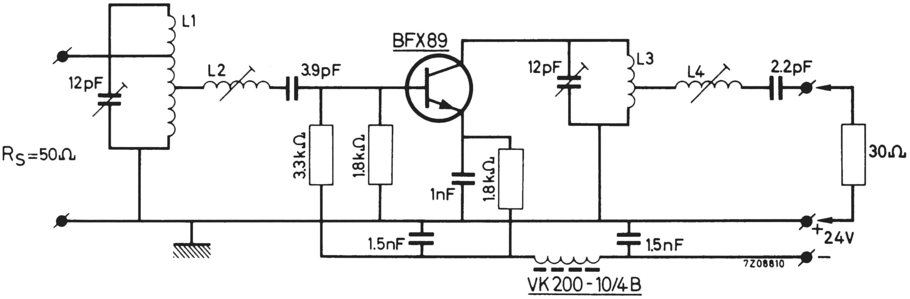
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics 1)

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 8 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9) P_o typ. 6 mW

Test circuit:


L1
12pF
R_S=50Ω
L2
3.9pF
BFX89
3.3kΩ
1.8kΩ
1nF
1.8kΩ
1.5nF
12pF
L3
L4
2.2pF
30Ω
+
24V
−
1.5nF
7Z08810
VK200-10/4B

Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm) winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm) winding pitch 2.2 mm; int. diam. 11 mm.

---

1) Shield lead grounded.

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
   This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

   in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
   This is so if $-C_L = +C_{oe}$,
   in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 1\ \mathrm{k\Omega}$; $C_L = -1.8\ \mathrm{pF}$

Adjustment procedure

1. Remove the transistor and connect a dummy consisting of a 1 kΩ resistor in parallel with a 1.8 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
   The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
   Corrections can be made by tuning L2; this will not disturb the band pass curve.

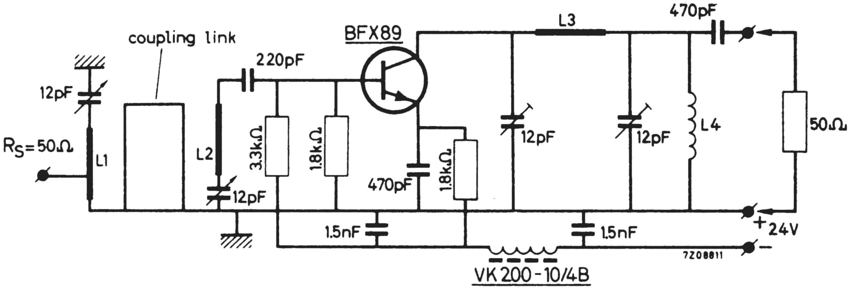
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics [1]

2. Output power at f = 800 MHz; T_{amb} = 25 °C

I_C = 8 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) P_o typ. 6 mW

Test circuit:



Coil data:

L1 = 24 mm x 6 mm x 0.5 mm silver plated Cu strip.
Tap of the input at 5 mm from earth.
L2 = 15 mm x 6 mm x 0.5 mm silver plated Cu strip.
L3 = 20 mm x 8 mm x 0.5 mm silver plated Cu strip.
L4 = 4 turns enamelled Cu wire (0.5 mm); winding pitch 1.5 mm;
int. diam. 4 mm.
Coupling link: 42 mm silver plated Cu wire (1 mm).

Basis of adjustment

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearily with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C\,(V_{CE} - V_{CEK})}{2} = 35 \text{ mW}$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 35 mW.
After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output is then ≤ 2 over the whole channel.

---

[1] Shield lead grounded

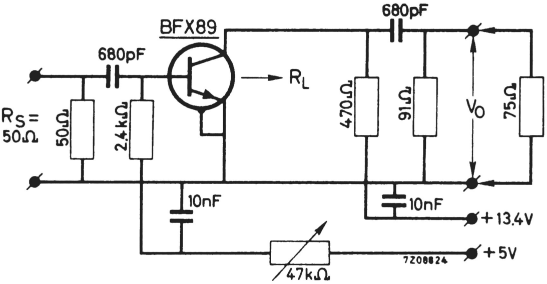
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

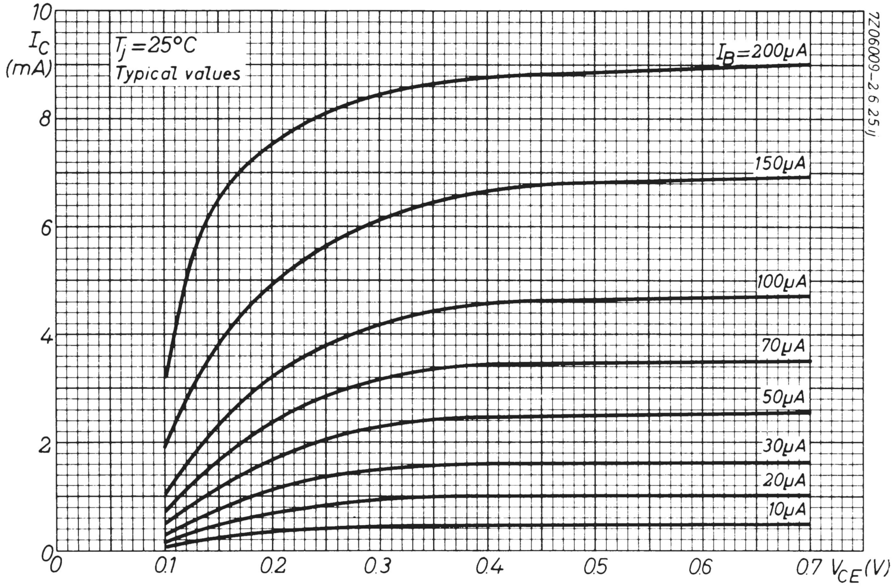
Intermodulation characteristics [1])

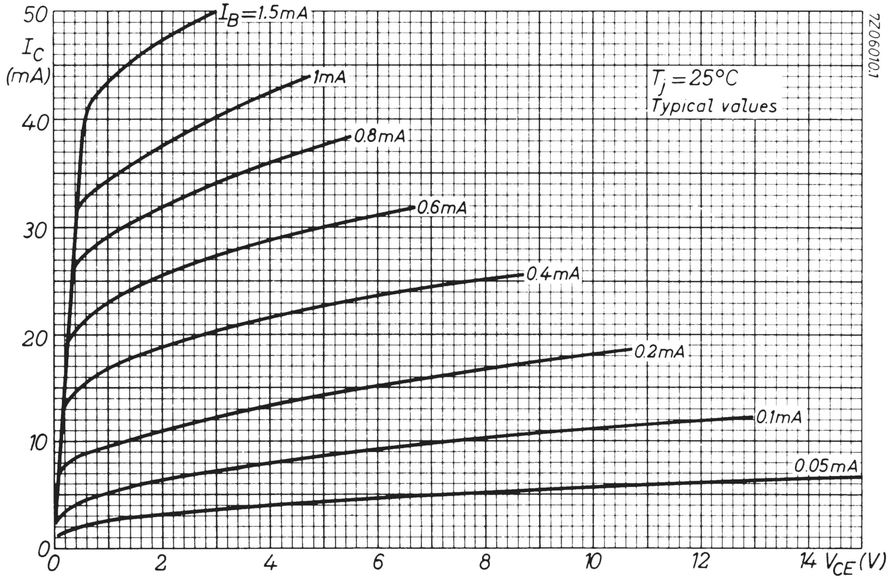
3. Intermodulation distortion

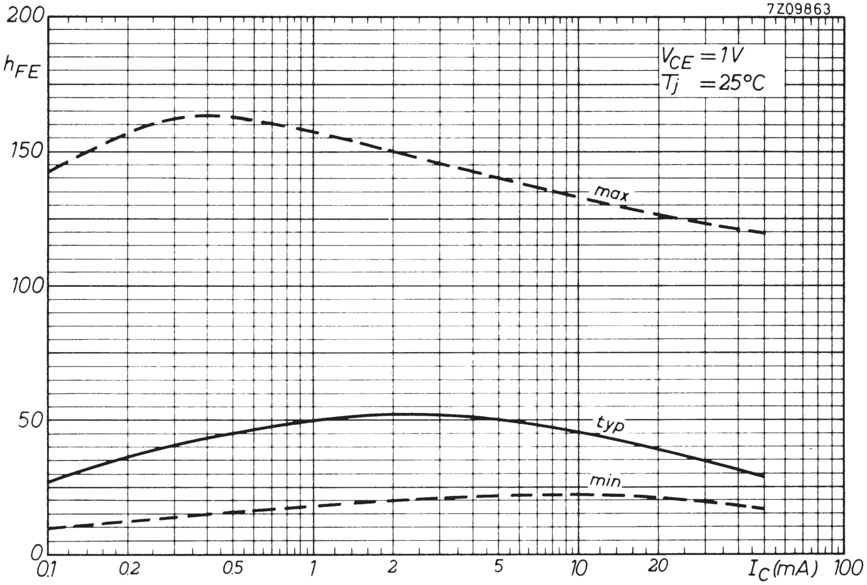
I_C = 8 mA; V_{CE} = 6 V; R_L = 37.5 Ω; T_{amb} = 25 °C
V_o = 100 mV at f_p = 183 MHz
V_o = 100 mV at f_q = 200 MHz
measured at $f_{(2q-p)}$ = 217 MHz d_{im} typ. −40 dB

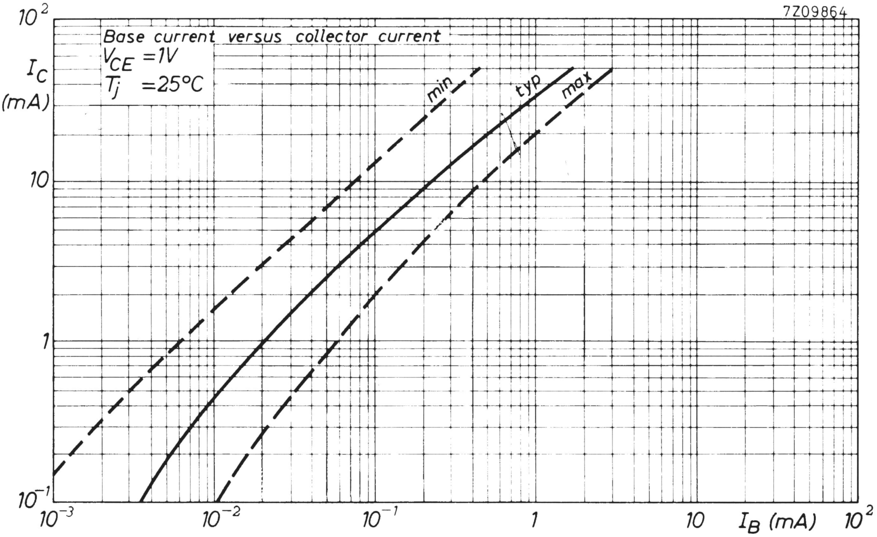
Test circuit:

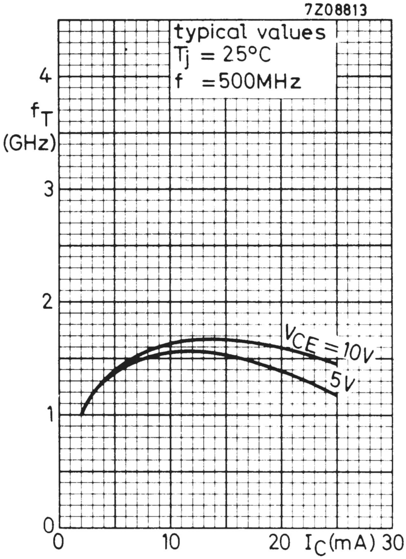

BFX89
680pF
680pF
R_L
R_S = 50Ω
50Ω
2.4kΩ
470Ω
91Ω
V_O
75Ω
10nF
10nF
+13.4V
+5V
47kΩ
7Z08824

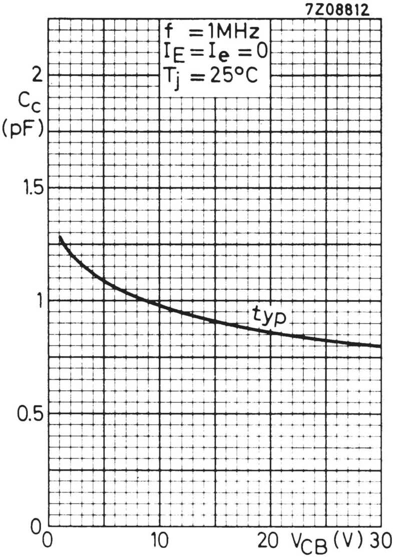

7Z06009-2 6 25 ij
I_C (mA)
10
8
6
4
2
0
$T_j = 25°C$
Typical values
$I_B = 200 \mu A$
150μA
100μA
70μA
50μA
30μA
20μA
10μA
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7 V_{CE} (V)

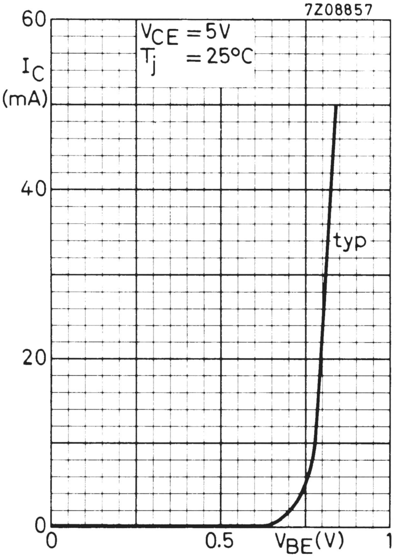

7Z06010.1
I_C (mA)
50
40
30
20
10
0
$I_B = 1.5 mA$
1mA
0.8mA
0.6mA
0.4mA
0.2mA
0.1mA
0.05mA
$T_j = 25°C$
Typical values
0
2
4
6
8
10
12
14 V_{CE} (V)

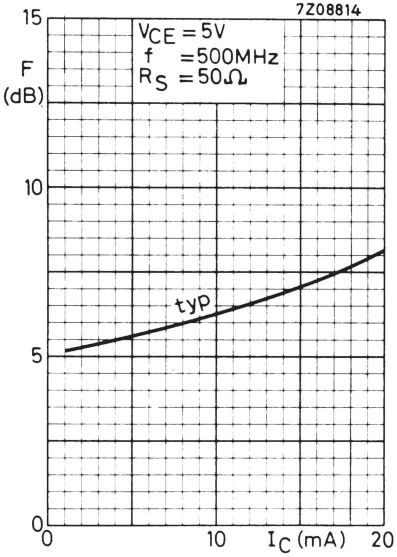

7Z09863
200
h_{FE}
150
100
50
0
$V_{CE} = 1V$
$T_j = 25°C$
max
typ
min
0.1
0.2
0.5
1
2
5
10
20
I_C (mA)
100

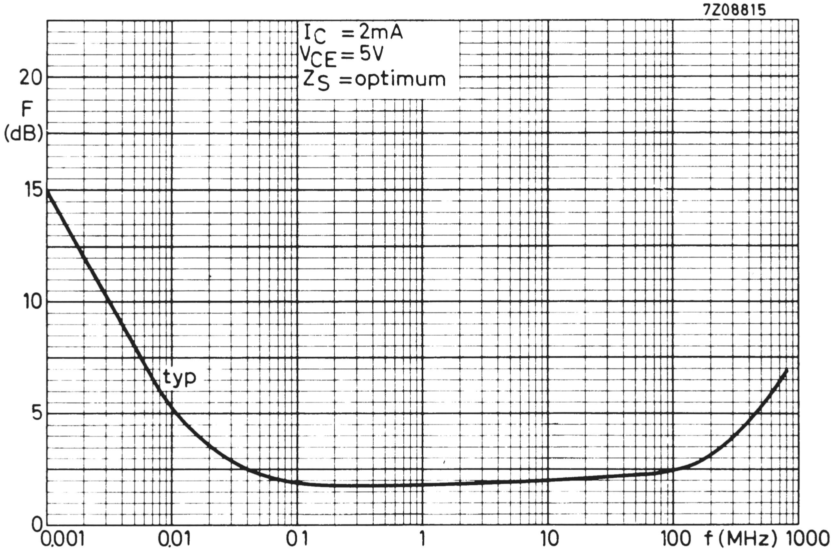

7Z09864
Base current versus collector current
$V_{CE} = 1V$
$T_j = 25°C$
10^2
I_C
(mA)
10
1
10^{-1}
min
typ
max
10^{-3}
10^{-2}
10^{-1}
1
10
I_B (mA)
10^2


7Z08813
typical values
T_j = 25°C
f = 500MHz
f_T
(GHz)
0
1
2
3
4
V_{CE} = 10V
5V
0
10
20
I_C(mA) 30


7Z08812
f = 1MHz
$I_E = I_e = 0$
T_j = 25°C
C_c
(pF)
0
0.5
1
1.5
2
typ
0
10
20
V_{CB} (V) 30


7Z08857
V_{CE} = 5V
T_j = 25°C
I_C
(mA)
0
20
40
60
typ
0
0.5
V_{BE}(V)
1


7Z08814
F (dB)
15
10
5
0
0
10
I_C (mA)
20
$V_{CE} = 5V$
f = 500MHz
$R_S = 50\Omega$
typ


7Z08815
F (dB)
20
15
10
5
0
0,001
0,01
0,1
1
10
100
f (MHz)
1000
$I_C = 2mA$
$V_{CE} = 5V$
Z_S = optimum
typ

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case.

The transistor has very low noise over a wide current range, a very high power gain and excellent intermodulation properties.

It is primarily intended for:

- Channel- and band aerial amplifiers for band I, II, III and IV/V (40-860 MHz)
- Wide band aerial amplifiers (40-860 MHz)
- Television distribution amplifiers
- Low noise wide band vertical amplifier in high speed oscilloscopes

It is also suitable for military- and industrial applications, such as:

- R.F. amplifiers and mixers for communication equipment
- Microwave telephony link systems, wide band i.f. amplifiers
- Large bandwidth radar i.f. amplifiers

QUICK REFERENCE DATA

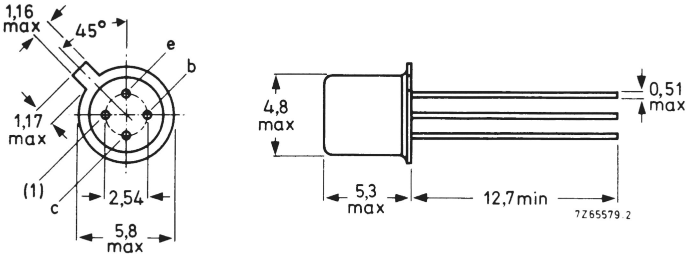
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.		30		V
Collector-emitter voltage (open base)	V_{CEO}	max.		15		V
Collector current (peak value; f > 1 MHz)	I_{CM}	max.		50		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		200		mW
Junction temperature	T_j	max.		200		°C
Transition frequency I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.		1.4		GHz
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V	C_{re}	typ.		0.6		pF
Noise figure at optimum source impedance			f = 200		800	MHz
I_C = 2 mA; V_{CE} = 5 V	F	typ.	2.5		5.5	dB
Power gain (not neutralized) I_C = 14 mA; V_{CE} = 10 V	G_p	typ.	23		8	dB
Output power d_{im} = −30 dB; V.S.W.R. at output < 2 I_C = 14 mA; V_{CE} = 10 V	P_o	typ.	12		12	mW

MECHANICAL DATA see page 2.

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	30	V
Collector-emitter voltage (peak value) $R_{BE} \leqslant 50\,\Omega$; $I_C = 10$ mA	V_{CERM}	max.	30	V
Collector-emitter voltage (open base); $I_C = 10$ mA	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2,5	V
Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value; $f > 1$ MHz)	I_{CM}	max.	50	mA
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	200	mW
Storage temperature	T_{stg}	−65 to +	200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	880	K/W*
From junction to case	$R_{th\ j\text{-}c}$	=	580	K/W*

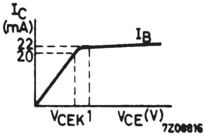
---

* K/W is SI unit for °C/W.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	10	nA
Knee voltage				
$I_C = 20$ mA; I_B = value for which $I_C = 22$ mA at $V_{CE} = 1$ V	V_{CEK}	<	0.75	V



D.C. current gain				
$I_C = 2$ mA; $V_{CE} = 1$ V	h_{FE}		25 to 150	
$I_C = 25$ mA; $V_{CE} = 1$ V	h_{FE}		20 to 125	
Transition frequency [1]				
$I_C = 2$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	> typ.	1.0 1.1	GHz GHz
$I_C = 25$ mA; $V_{CE} = 5$ V; f = 500 MHz	f_T	> typ.	1.3 1.4	GHz GHz
Collector capacitance at f = 1 MHz [2]				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	<	1.5	pF
Feedback capacitance at f = 1 MHz [1]				
$I_C = 2$ mA; $V_{CE} = 5$ V	$-C_{re}$	typ. <	0.6 0.8	pF pF
Noise figure [1]				
$I_C = 2$ mA; $V_{CE} = 5$ V				
f = 100 kHz; optimum source resistance	F	<	4	dB
f = 200 MHz; optimum source impedance	F	<	3.5	dB
f = 500 MHz; $R_S = 50\ \Omega$	F	<	5	dB
f = 800 MHz; optimum source impedance	F	typ.	5.5	dB

			f = 200	800	MHz
Power gain (not neutralized) [1] $I_C = 14$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	G_p	>	21		dB
		typ.	23	8	dB

---

[1] Shield lead grounded.

[2] Shield lead not connected.

CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

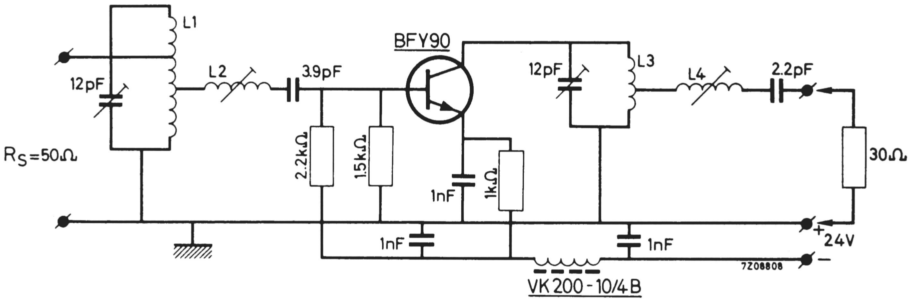
Intermodulation characteristics [1]

1. Output power at f = 200 MHz; T_{amb} = 25 °C

I_C = 14 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 202 MHz; f_q = 205 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 208 MHz (Channel 9)

P_o	>	10	mW
	typ.	12	mW

Test circuit:


L1
12pF
L2
3.9pF
BFY90
12pF
L3
L4
2.2pF
R_S=50Ω
2.2kΩ
1.5kΩ
1nF
1kΩ
30Ω
1nF
1nF
+
24V
−
7Z08808
VK200-10/4B

Coil data:

L1 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 2.7 mm; int. diam. 8 mm; taps at 0.5 turn and 1.5 turns from earth.
L2 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 8 mm.
L3 = 3 turns silver plated Cu wire (1.4 mm); winding pitch 3.3 mm; int. diam. 8 mm.
L4 = 5.5 turns silver plated Cu wire (1.4 mm); winding pitch 2.2 mm; int. diam. 11 mm.

---

[1] Shield lead grounded

CHARACTERISTICS (continued)

Basis of adjustment

The intermodulation at an intermodulation distortion of −30 dB is caused by h.f. output current - voltage clipping.
The maximum undistorted output power is realised, if

a. Current and voltage clipping take place concurrently.
This occurs if

$$R_L = \frac{V_{CE} - V_{CEK}}{I_C},$$

in which V_{CEK} is the high frequency knee voltage.

b. The h.f. collector current is as small as possible.
This is so if $-C_L = +C_{oe}$,
in which C_{oe} is the output capacitance of the transistor at short circuited input.

For maximum output power at an intermodulation distortion of −30 dB, the (experimentally found) values of R_L and C_L are:
$R_L = 560\ \Omega$; $C_L = -1.8$ pF

Adjustment procedure

1. Remove the transistor and connect a dummy consisting of a 560 Ω resistor in parallel with a 1.8 pF capacitor between the collector and emitter connections of the output circuit.
2. Tune and match the output circuit for zero reflection at 205 MHz (V.S.W.R. = 1). After this adjustment, no further change may be made in the output circuit.
3. Replace the dummy by the transistor. Tune and match the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output will then, in most cases, be ≤ 2 over the whole channel.
Corrections can be made by tuning L2; this will not disturb the band pass curve.

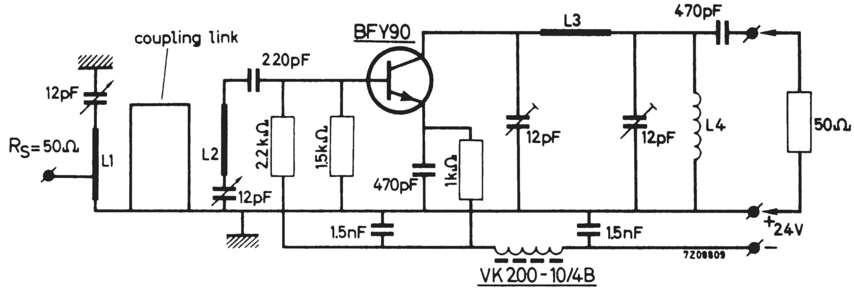
CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics [1]

2. Output power at f = 800 MHz; T_{amb} = 25 °C

I_C = 14 mA; V_{CE} = 10 V; V.S.W.R. at output < 2
f_p = 798 MHz; f_q = 802 MHz; d_{im} = −30 dB
measured at $f_{(2q-p)}$ = 806 MHz (Channel 62) P_o typ. 12 mW

Test circuit:



Coil data:

L1 = 24 mm x 6 mm x 0.5 mm silver plated Cu strip.
Tap of the input at 5 mm from earth.
L2 = 15 mm x 6 mm x 0.5 mm silver plated Cu strip.
L3 = 20 mm x 8 mm x 0.5 mm silver plated Cu strip.
L4 = 4 turns enamelled Cu wire (0.5 mm); winding pitch 1.5 mm; int. diam. 4 mm
Coupling link: 42 mm silver plated Cu wire (1 mm).

Basis of adjustment.

At 800 MHz no dummy can be used to adjust for optimum collector load because at these frequencies the impedance transformations of a dummy are too high. A small signal at the mid-channel frequency of 802 MHz is fed to the input and increased until clipping occurs; that is, until the output power no longer increases linearly with the input signal. This clipping can be eliminated by tuning the output circuit, thereby making the output power equal to

$$P_o = \frac{I_C\,(V_{CE} - V_{CEK})}{2} = 60 \text{ mW}$$

The output circuit is adjusted for minimum intermodulation if the input signal is as small as possible at P_o = 60 mW.
After this adjustment has been made no further change may be made in the output circuit.
Adjust the input circuit for maximum power gain and good band pass curve.
The V.S.W.R. of the output is then $\leq$ 2 over the whole channel.

---

[1] Shield lead grounded

CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

Intermodulation characteristics [1]

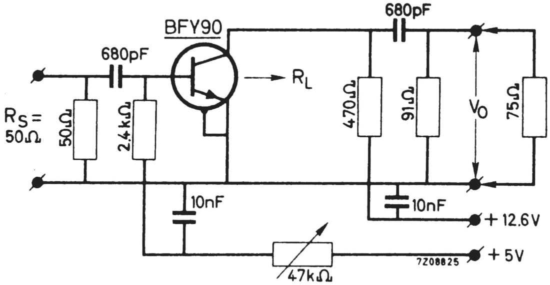
3. Intermodulation distortion

I_C = 14 mA; V_{CE} = 6 V; R_L = 37.5 Ω; T_{amb} = 25 °C

V_o = 100 mV at f_p = 183 MHz

V_o = 100 mV at f_q = 200 MHz
measured at $f_{(2q-p)}$ = 217 MHz d_{im} typ. -50 dB

Test circuit:



y parameters at f = 500 MHz (common emitter) [1]

I_C = 2 mA; V_{CE} = 5 V

Input conductance	g_{ie}	typ.	16	$m\Omega^{-1}$
Input capacitance	C_{ie}	typ.	3.75	pF
Feedback admittance	$\lvert y_{re}\rvert$	typ.	1.55	$m\Omega^{-1}$
Phase angle of feedback admittance	φ_{re}	typ.	258°	
Transfer admittance	$\lvert y_{fe}\rvert$	typ.	45	$m\Omega^{-1}$
Phase angle of transfer admittance	φ_{fe}	typ.	285°	
Output conductance	g_{oe}	typ.	0.19	$m\Omega^{-1}$
Output capacitance	C_{oe}	typ.	1.9	pF

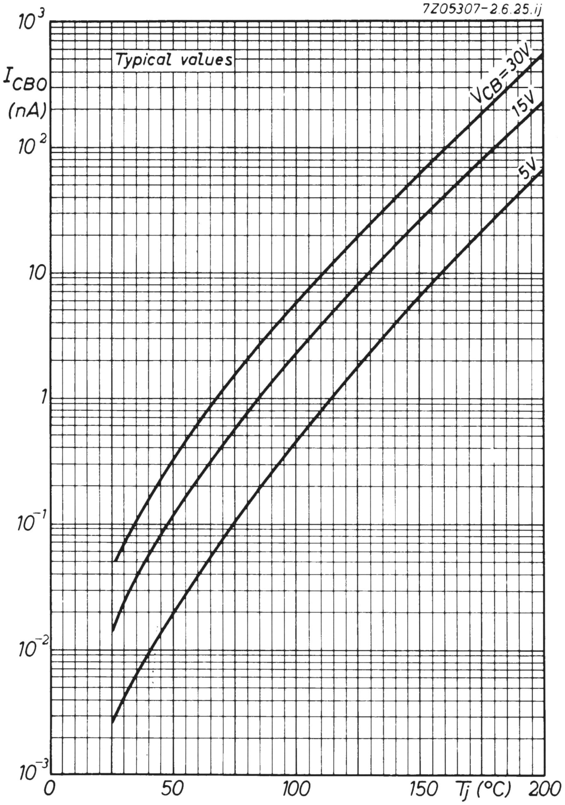
Maximum unilateralised power gain

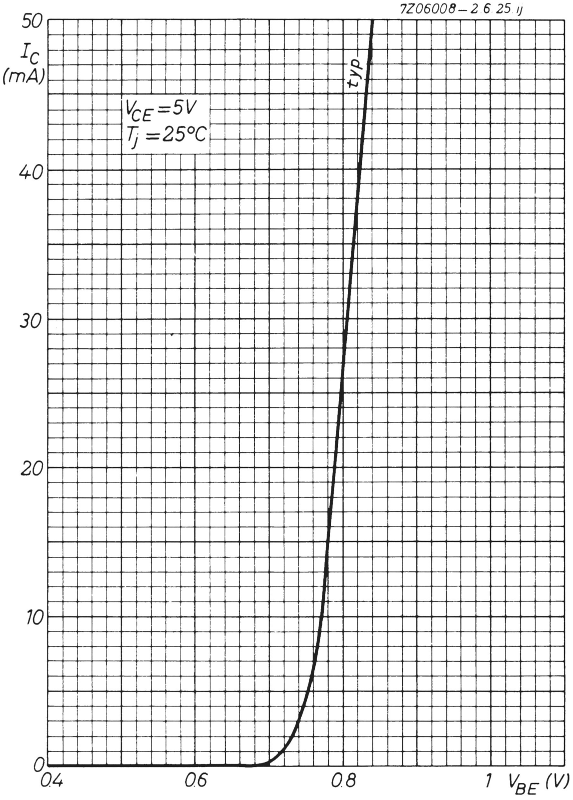
$$G_{UM} = \frac{|y_{fe}|^2}{4 g_{ie} g_{oe}}$$

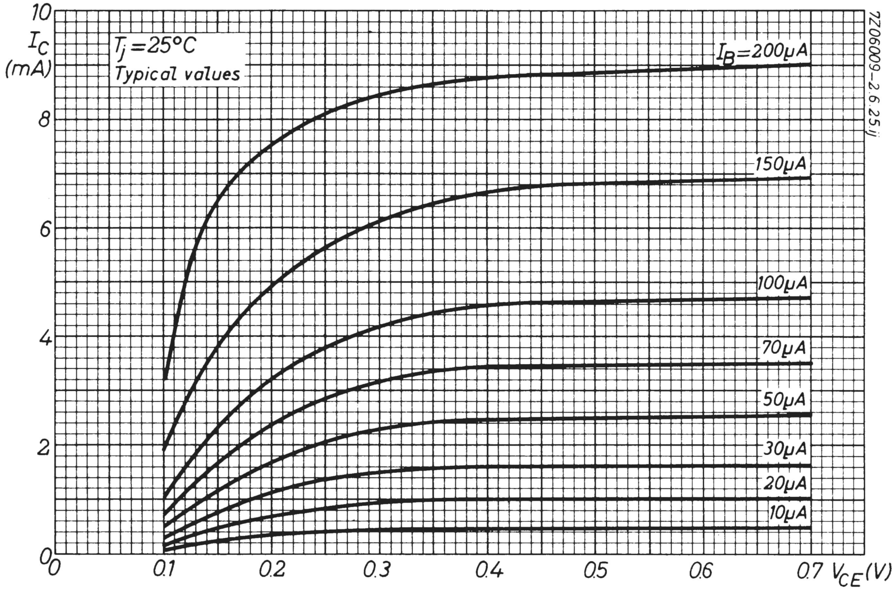
I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz G_{UM} typ. 22 dB

---

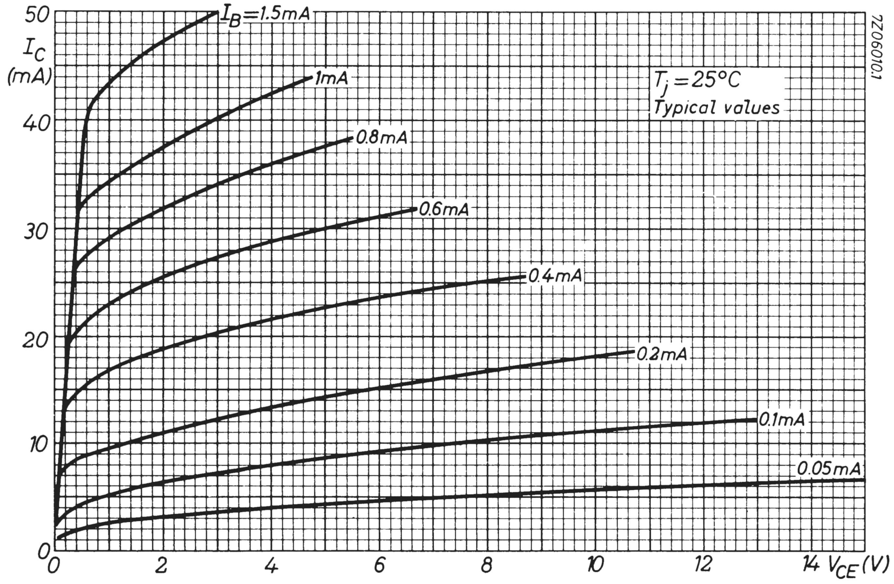
[1] Shield lead grounded


7Z05307-2.6.25.ij
Typical values
I_{CBO} (nA)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
0
50
100
150
200
T_j (°C)
V_{CB}=30V
15V
5V

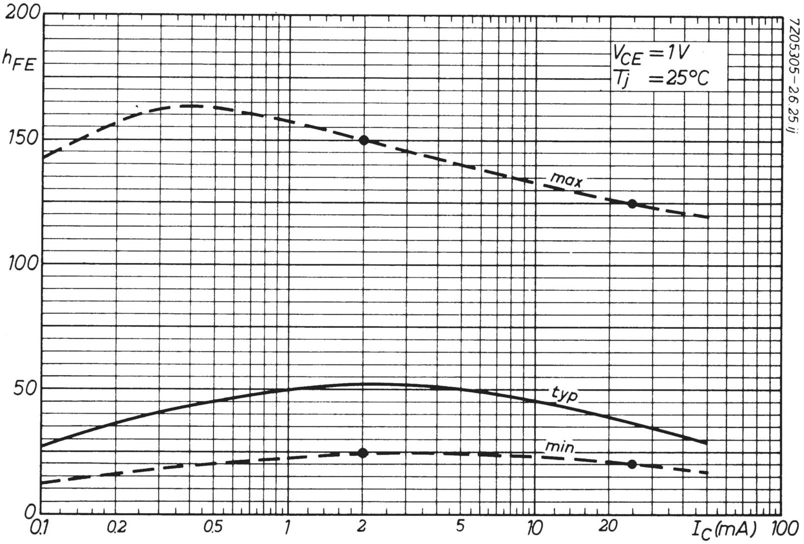

7Z06008–2.6.25.ij
50
I_C
(mA)
40
30
20
10
0
0.4
0.6
0.8
1
V_{BE} (V)
V_{CE} = 5V
T_j = 25°C
typ



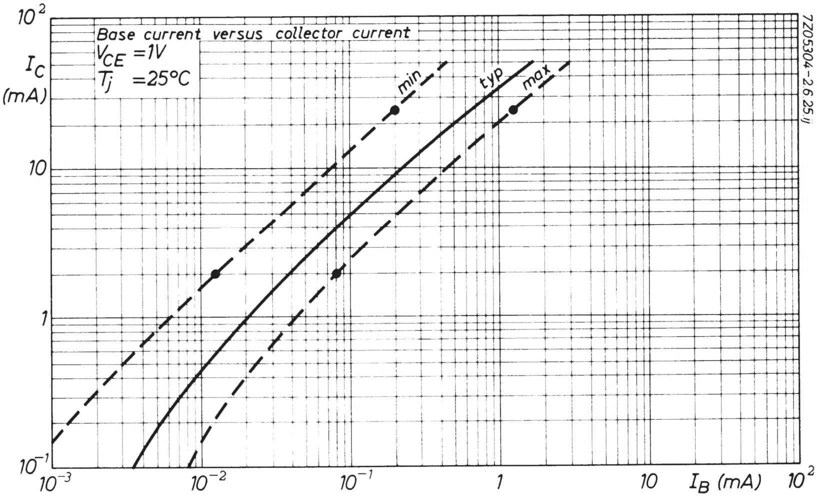
10
8
6
4
2
0
I_C (mA)
$T_j = 25°C$
Typical values
$I_B = 200\mu A$
150µA
100µA
70µA
50µA
30µA
20µA
10µA
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
V_{CE} (V)
7Z06009-2.6.25.1



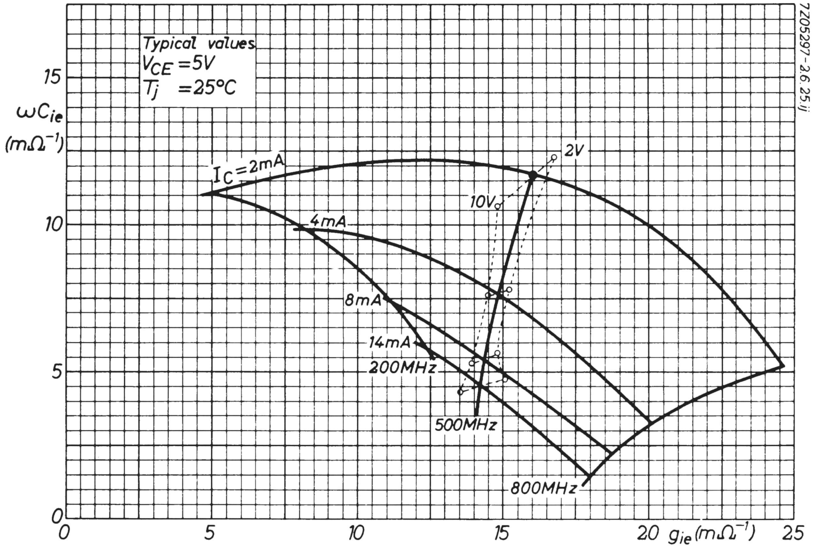
50
40
30
20
10
0
I_C (mA)
$I_B = 1.5mA$
1mA
0.8mA
0.6mA
0.4mA
0.2mA
0.1mA
0.05mA
$T_j = 25°C$
Typical values
0
2
4
6
8
10
12
14
V_{CE} (V)
7Z06010.1

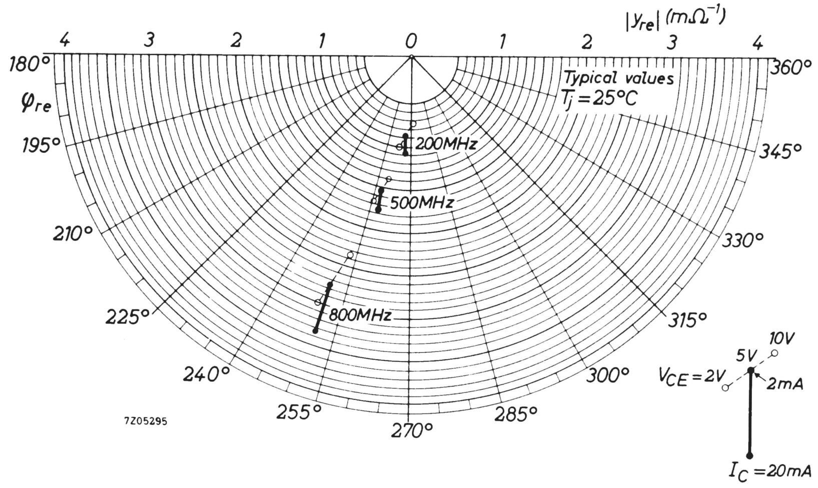


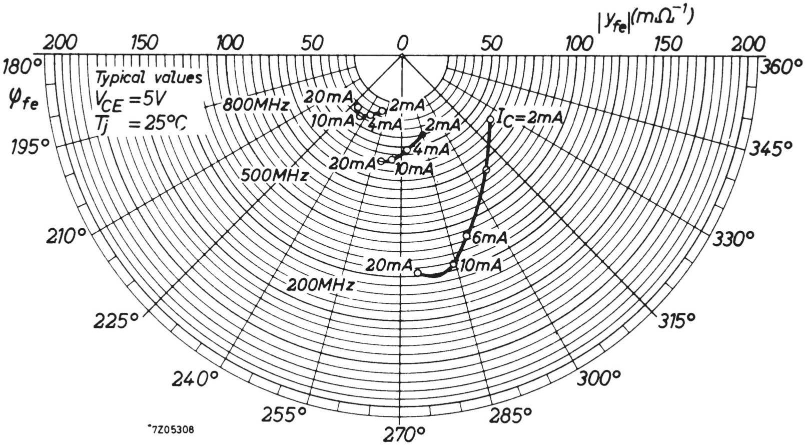
200
h_{FE}
150
100
50
0
$V_{CE} = 1V$
$T_j = 25°C$
max
typ
min
0.1
0.2
0.5
1
2
5
10
20
I_C (mA)
100
7Z05305-26.25.ij

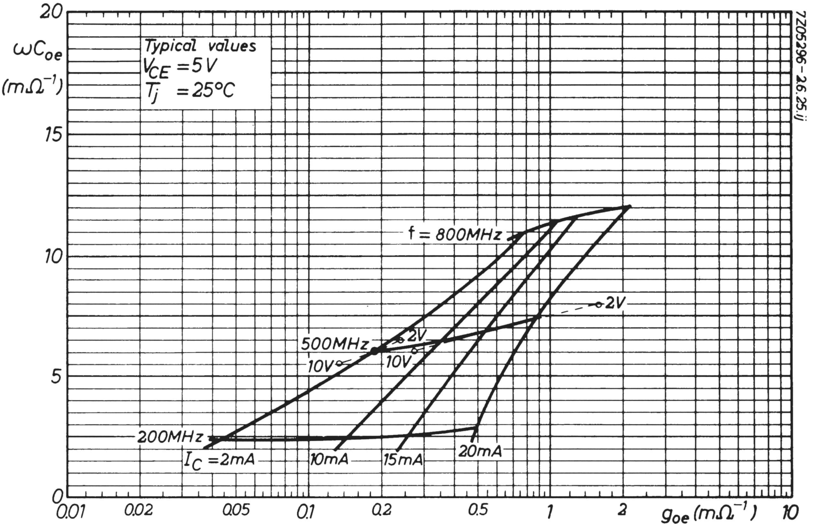


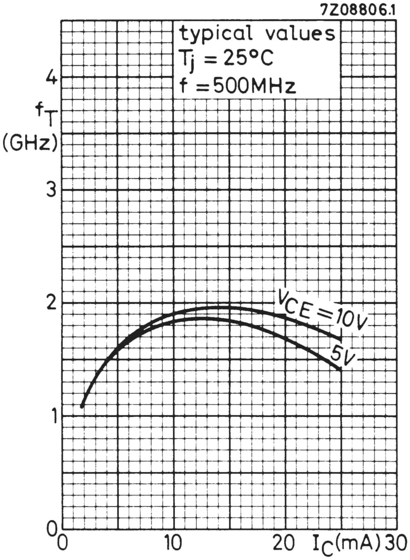
Base current versus collector current
$V_{CE} = 1V$
$T_j = 25°C$
10^2
I_C (mA)
10
1
10^{-1}
min
typ
max
10^{-3}
10^{-2}
10^{-1}
1
10
I_B (mA)
10^2
7Z05304-26.25.ij

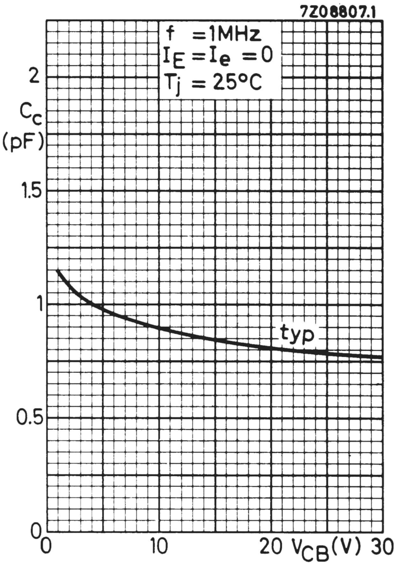

Typical values
V_{CE} = 5V
T_j = 25°C
ωC_{ie} ($m\Omega^{-1}$)
15
10
5
0
0
5
10
15
20
25
g_{ie} ($m\Omega^{-1}$)
I_C = 2mA
4mA
8mA
14mA
200MHz
500MHz
800MHz
2V
10V
7Z05297-2.6.25.ij

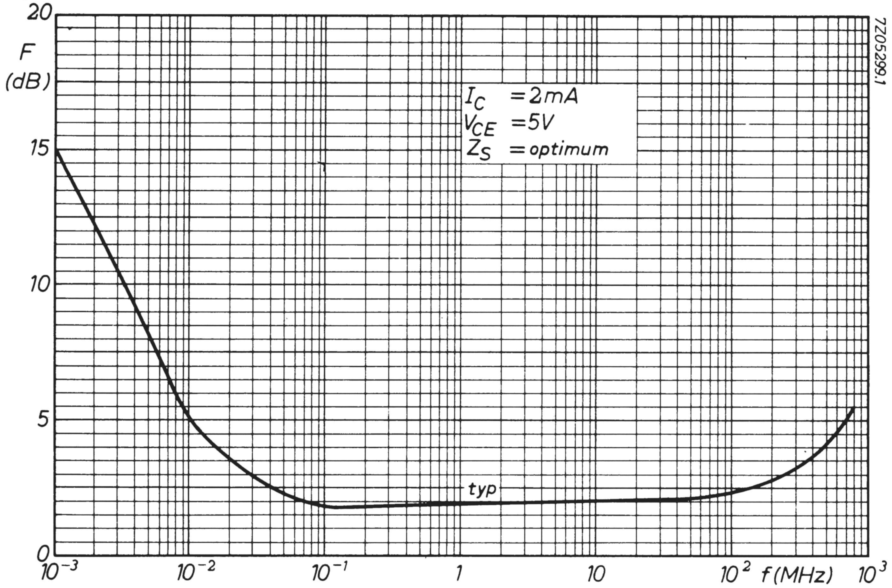

$|y_{re}|$ ($m\Omega^{-1}$)
4
3
2
1
0
1
2
3
4
180°
φ_{re}
195°
210°
225°
240°
255°
270°
285°
300°
315°
330°
345°
360°
Typical values
T_j = 25°C
200MHz
500MHz
800MHz
V_{CE} = 2V
5V
10V
2mA
I_C = 20mA
7Z05295

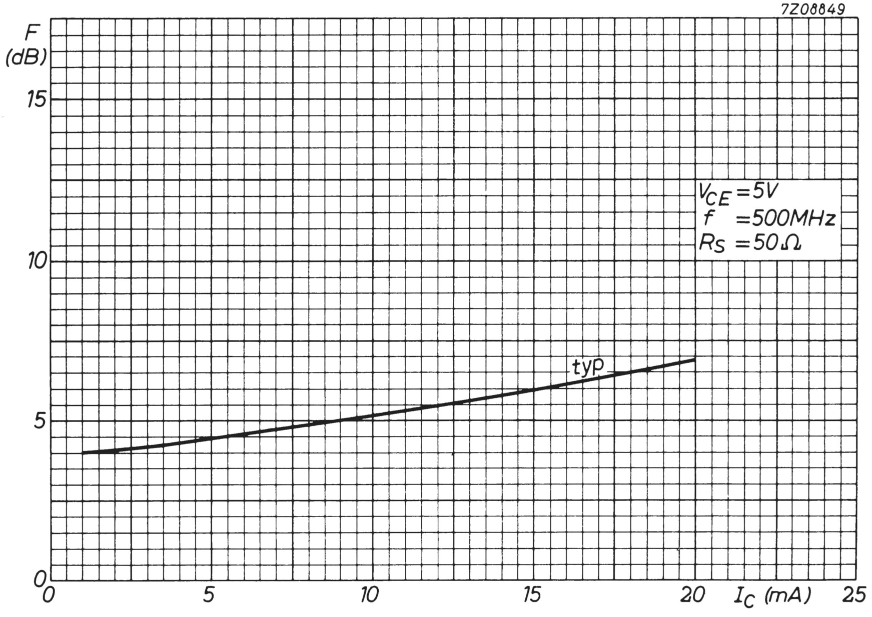

$|y_{fe}|$ (mΩ^{-1})
200
150
100
50
0
50
100
150
200
180°
φ_{fe}
195°
210°
225°
240°
255°
270°
285°
300°
315°
330°
345°
360°
Typical values
V_{CE} = 5V
T_j = 25°C
800MHz
500MHz
200MHz
20mA
10mA
4mA
2mA
2mA
4mA
20mA
10mA
I_C = 2mA
6mA
20mA
10mA
7Z05308


20
15
10
5
0
ωC_{oe}
(mΩ^{-1})
Typical values
V_{CE} = 5V
T_j = 25°C
f = 800MHz
500MHz
200MHz
2V
10V
10V
2V
2V
I_C = 2mA
10mA
15mA
20mA
0.01
0.02
0.05
0.1
0.2
0.5
1
2
10
g_{oe} (mΩ^{-1})
7Z05296 - 26.25.ii


7Z08806.1
typical values
$T_j = 25°C$
f = 500MHz
f_T (GHz)
4
3
2
1
0
0
10
20
30
I_C (mA)
$V_{CE} = 10V$
5V


7Z08807.1
f = 1MHz
$I_E = I_e = 0$
$T_j = 25°C$
C_c (pF)
2
1.5
1
0.5
0
0
10
20
30
V_{CB} (V)
typ


20
F
(dB)
15
10
5
0
I_C = 2mA
V_{CE} = 5V
Z_S = optimum
typ
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
f (MHz)
10^3
7Z05299.1


7Z08849
F
(dB)
15
10
5
0
V_{CE} = 5V
f = 500MHz
R_S = 50Ω
typ
0
5
10
15
20
I_C (mA)
25

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. The 2N918 is primarily intended for low power amplifiers and oscillators in the v.h.f. and u.h.f. ranges for industrial service.

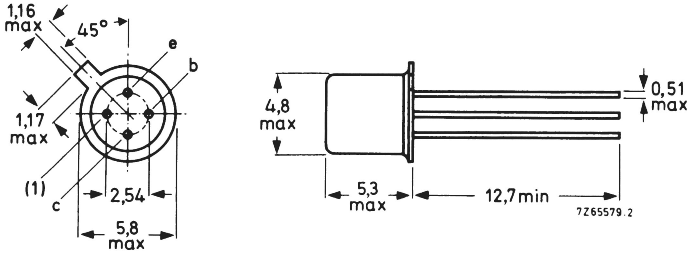
QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	200	°C
Transition frequency I_C = 6 mA; V_{CE} = 10 V	f_T	>	900	MHz
Maximum unilateralized power gain I_C = 6 mA; V_{CE} = 12 V; f = 200 MHz	G_{UM}	typ.	36	dB
Noise figure at f = 60 MHz I_C = 1 mA; V_{CE} = 6 V; R_S = 400 Ω	F	<	6	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-72.



(1) = shield lead (connected to case).

Accessories: 56246 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector-emitter voltage (open base) I_C = 3 mA	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V

Currents

Collector current (d.c.)	I_C	max.	50	mA

Power dissipation

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Temperatures

Storage temperature	T_{stg}	-65 to +200		°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	0.88	°C/mW
From junction to case	$R_{th\ j-c}$	=	0.58	°C/mW

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified
All measurements taken with ungrounded shield lead

Collector cut-off current				
$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	10	nA
$I_E = 0$; $V_{CB} = 15$ V; $T_j = 150$ °C	I_{CBO}	<	1	μA
Saturation voltages				
$I_C = 10$ mA; $I_B = 1$ mA	V_{CEsat}	<	0.4	V
	V_{BEsat}	<	1	V
D.C. current gain				
$I_C = 3$ mA; $V_{CE} = 1$ V	h_{FE}	>	20	
Collector capacitance at f = 140 kHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	<	1.7	pF
$I_E = I_e = 0$; $V_{CB} = 0$	C_c	<	3.0	pF
Emitter capacitance at f = 140 kHz				
$I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	<	2.0	pF
Transition frequency				
$I_C = 6$ mA; $V_{CE} = 10$ V 1)	f_T	>	900	MHz
Noise figure at f = 60 MHz				
$I_C = 1$ mA; $V_{CE} = 6$ V; $R_S = 400\ \Omega$	F	<	6	dB
Oscillator power output at f = 500 MHz				
$-I_E = 8$ mA; $V_{CB} = 15$ V	P_o	>	30	mW
Maximum unilateralised power gain				
$G_{UM} = \frac{\lvert y_{fe}\rvert^2}{4g_{ie}g_{oe}}$				
$I_C = 6$ mA; $V_{CE} = 12$ V; f = 200 MHz	G_{UM}	typ.	36	dB

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1) JEDEC registration: $I_C = 4$ mA; $V_{CE} = 10$ V, $f_T > 600$ MHz.

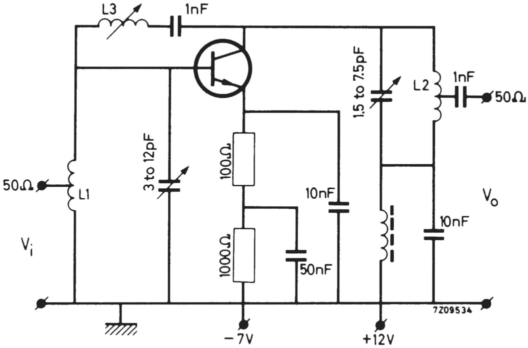
CHARACTERISTICS (continued) $T_j = 25\ ^{o}C$

Available power gain at f = 200 MHz

I_C = 6 mA G_p > 15 dB

Basic circuit for measuring the available neutralised power gain

Grounded shield lead


L3
1nF
1.5 to 7.5pF
L2
1nF
50Ω
50Ω
L1
3 to 12pF
100Ω
10nF
V_o
10nF
1000Ω
50nF
V_i
7Z09534
−7V
+12V

L1 = 3.5 turns tinned Cu wire, 1.3 mm
d = 8 mm; length = 11 mm

Tap at ≈ 2 turns from earth side

L2 = 8 turns tinned Cu wire, 1.3 mm
d = 3 mm; length = 22 mm

Tap at 1 turn from earth side

L3 = 0.4 to 0.65 μH

CATV AMPLIFIER MODULES (V.H.F.)

Selection guide
Accessory

CATV AMPLIFIER MODULES

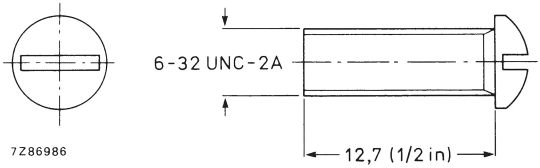
type number	frequency range MHz	power gain (dB) at f = 50 MHz	application	V_o (dBmV) at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone)
BGY61	5 - 200	13,0 ± 0,5	reverse amplifiers	⩾ 64
BGY65		18,5 ± 0,5		⩾ 65
BGY67		22,5 ± 0,5		⩾ 64
BGY50	40 - 300	12,5 ± 0,4	preamplifier	⩾ 61
BGY51			post amplifier	⩾ 63,5
BGY52	40 - 300	16,4 ± 0,4	preamplifier	⩾ 61
BGY53			post amplifier	⩾ 63,5
BGY54	40 - 300	17,0 ± 0,4	preamplifier	⩾ 61
BGY55			post amplifier	⩾ 63,5
BGY56	40 - 300	22,0 ± 0,6	preamplifier	⩾ 61,5
BGY57			post amplifier	⩾ 64
BGY58	40 - 300	33,0 ± 1,0	line extender	⩾ 64
BGY58A	40 - 330	34,0 ± 1,0	line extender	⩾ 64
BGY59	40 - 300	38,5 ± 1,0	line extender	⩾ 64
BGY60	40 - 300	33,3 ± 1,0	interstage amplifier (2 x 17 dB)	⩾ 64
BGY70	40 - 450	12,5 ± 0,4	preamplifier	⩾ 62,5
BGY71			post amplifier	⩾ 65
BGY74	40 - 450	17,0 ± 0,4	preamplifier	⩾ 62,5
BGY75			post amplifier	⩾ 65
BGY78	40 - 450	34,0 ± 1,0	line extender	⩾ 62

All modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

ACCESSORY

ROUND HEAD SCREW 6-32 UNC-2A

Available, upon request, under type number 56396 or 12 NC code number 9390 298 10xx0.



The BGY53 is the replacement type for the BGY37.

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems.

QUICK REFERENCE DATA

			BGY50	BGY51	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		12,5 ± 0,4	12,5 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,2 to + 0,8	+ 0,2 to + 0,8	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	0,2	0,2	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	18	18	dB
Output voltage at d_{im} = –60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	61	63,5	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	–68	–70	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	7	8	dB
D.C. supply voltage	$+V_B$	=	24	24	V *
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		–20 to + 90	–20 to + 90	°C

MECHANICAL DATA

SOT-115 (see page 2).

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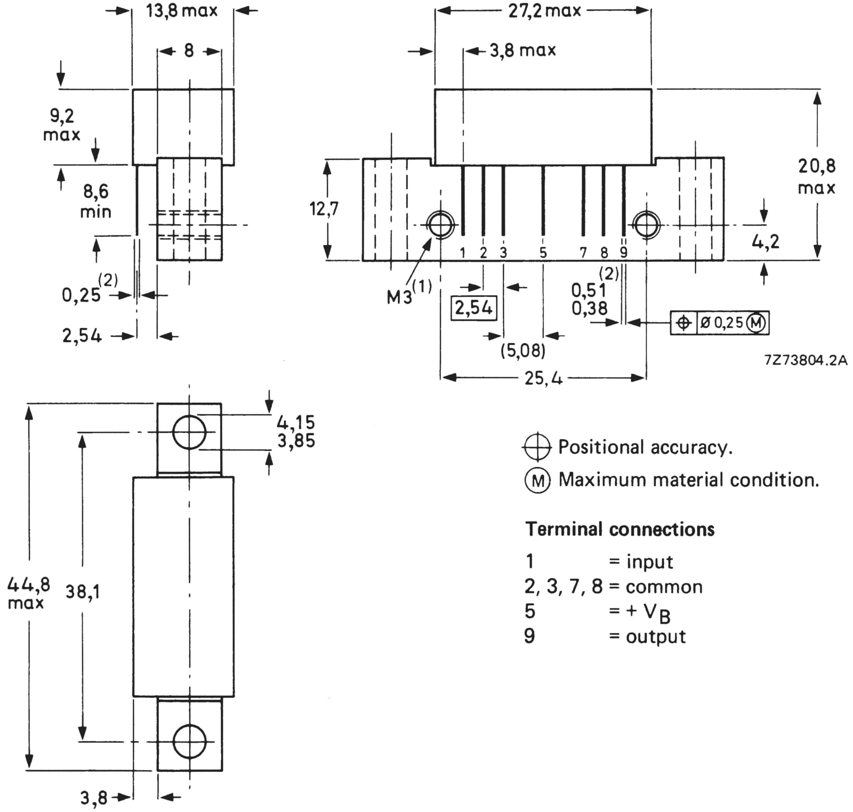
* The modules are able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.


13,8 max
8
9,2 max
8,6 min
0,25 (2)
2,54
27,2 max
3,8 max
20,8 max
12,7
4,2
1 2 3 5 7 8 9
M3 (1)
2,54
(2)
0,51
0,38
⌖ Ø 0,25 Ⓜ
(5,08)
25,4
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

⌖ Positional accuracy.

Ⓜ Maximum material condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

(1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see Accessory).

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	67 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C*

* With a heatsink ⩽ 4,7 K/W for the BGY51, and ⩽ 5,8 K/W for the BGY50 a maximum ambient temperature of + 65 °C is permissible. (K/W is SI unit for °C/W.)

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY50	BGY51	
Power gain at f = 50 MHz	G_p		12,5 ± 0,4	12,5 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			+0,2 to +0,8	+0,2 to +0,8	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	0,2	0,2	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 300 MHz		⩾	18	18	dB
Output voltage at $d_{im} = -60$ dB (DIN 45004, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o -6$ dB; f_q = 294,25 MHz $V_r = V_o -6$ dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	61	63,5	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	⩽	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	7	8	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems.

QUICK REFERENCE DATA

			BGY52	BGY53	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		16,4 ± 0,4	16,4 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	0,1	0,1	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	18	18	dB
Output voltage at $d_{im} = -60$ dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	61	63,5	dBmV
2nd harmonic distortion at $V_o = 50$ dBmV	d_2	⩽	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
D.C. supply voltage	$+V_B$	=	24	24	V *
Total d.c. current consumption at $V_B = +24$ V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	−20 to + 90	°C

MECHANICAL DATA

SOT-115 (see page 2).

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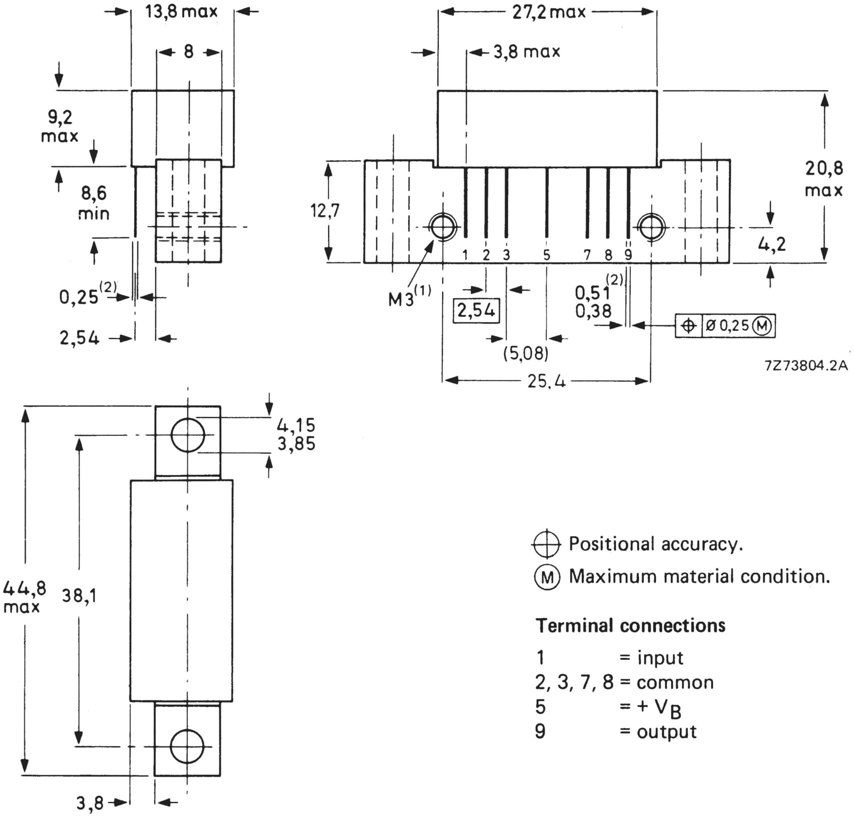
* The modules are able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.


13,8 max
8
9,2 max
8,6 min
0,25(2)
2,54
27,2 max
3,8 max
12,7
20,8 max
4,2
1 2 3 5 7 8 9
M3(1)
2,54
(5,08)
0,51(2)
0,38
Ø 0,25 M
25,4
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

⌖ Positional accuracy.

Ⓜ Maximum material condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

(1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see Accessory).

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}		−40 to +100 °C
Operating mounting base temperature	T_{mb}		−20 to +90 °C *

* With a heatsink ⩽ 4,7 K/W for the BGY53, and ⩽ 5,8 K/W for the BGY52 a maximum ambient temperature of + 65 °C is permissible. (K/W is SI unit for °C/W.)

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C			BGY52	BGY53	
Power gain at f = 50 MHz	G_p		16,4 ± 0,4	16,4 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	0,1	0,1	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 300 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	61	63,5	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	⩽	−68	−70	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

CATV AMPLIFIER MODULES

Hybrid amplifier modules for CATV systems operating at frequencies up to 300 MHz.

BGY54: 17 dB input amplifier module;
BGY55: 17 dB output amplifier module.

Features:

- excellent linearity;
- extremely low noise;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

			BGY54	BGY55	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to 1,0	0 to 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		$\leqslant$	± 0,1	± 0,1	dB
Return losses at input and output f = 40 MHz to 300 MHz		$\geqslant$	20	20	dB
Output voltage at d_{im} = –60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	$\geqslant$	61	63,5	dBmV
2nd order distortion at channel R V_o = 50 dBmV on channel 2 and 13	d_2	$\leqslant$	–71	–73	dB
Composite triple beat 32 channels V_o = 46 dBmV		$\leqslant$	–65	–67	dB
Output capability X_{mod} = –57 dB; 32 channels flat	V_o	$\geqslant$	47,5	50	dBmV
Noise figure f = 40 MHz to 300 MHz	F	$\leqslant$	6	6,5	dB
D.C. supply voltage	$+V_B$	=	24	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		–20 to + 90	–20 to + 90	°C

MECHANICAL DATA

SOT-115 (see Fig. 1).

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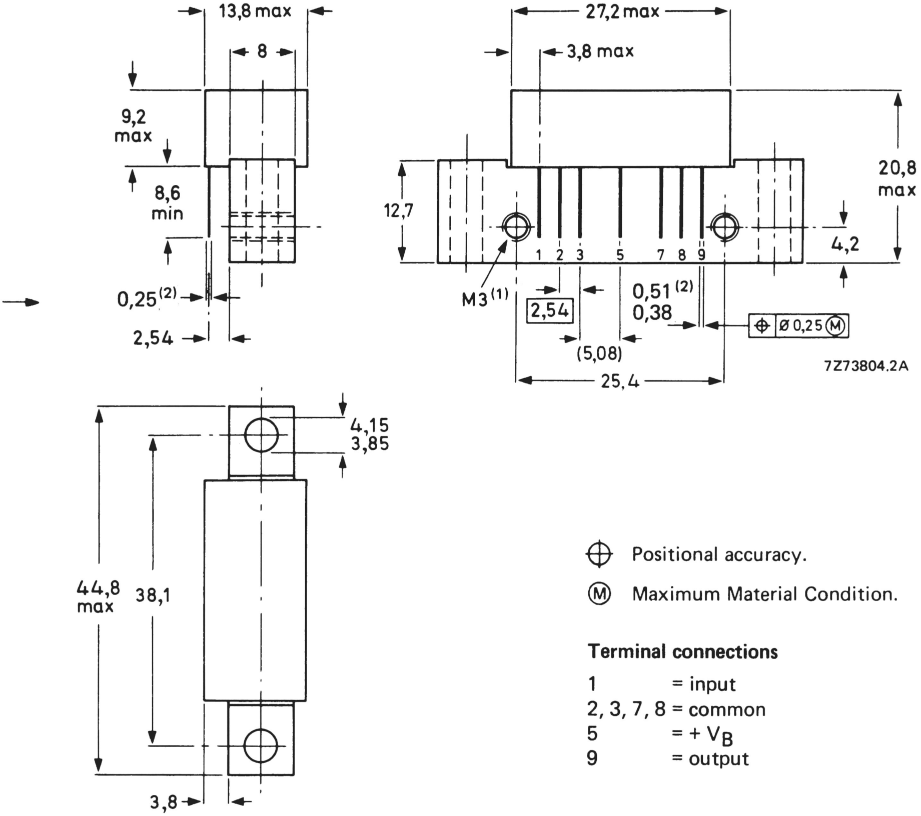
* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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3,8 max
20,8 max
12,7
4,2
1 2 3 5 7 8 9
M3(1)
2,54
0,51(2)
0,38
(5,08)
25,4
⌖ Ø 0,25 Ⓜ
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

⌖ Positional accuracy.

Ⓜ Maximum Material Condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

(1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see Accessory).

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	65	dBmV
Storage temperature	T_{stg}		−40 to + 100	°C
Operating mounting base temperature	T_{mb}		−20 to + 90	°C*

* With a heatsink ≤ 4,7 K/W for the BGY55, and ≤ 5,8 K/W for the BGY54 a maximum ambient temperature of + 65 °C is permissible. (K/W is SI unit for °C/W).

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY54	BGY55	
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to 1,0	0 to 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	± 0,1	± 0,1	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 300 MHz		≥	20	20	dB
Output voltage at $d_{im} = -60$ dB (DIN 45004, 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o - 6$ dB; f_q = 294,25 MHz $V_r = V_o - 6$ dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	61	63,5	dBmV
2nd order distortion V_o = 50 dBmV; channel 2 V_o = 50 dBmV; channel 13 Measured at channel R	d_2	≤	−71	−73	dB
Composite triple beat 32 channels V_o = 46 dBmV; channel W		≤	−65	−67	dB
Output capability on channel W $X_{mod} = -57$ dB; 32 channels flat	V_o	≥	47,5	50	dBmV
Noise figure f = 40 MHz to 300 MHz	F	≤	6	6,5	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		≤	180	220	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULES

Hybrid amplifier modules intended for CATV systems.

QUICK REFERENCE DATA

			BGY56	BGY57	
Frequency range	f		40 to 300	40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		22,0 ± 0,6	22,0 ± 0,6	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,2	± 0,2	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	20	20	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	61,5	64	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−64	−66	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
D.C. supply voltage	$+V_B$	=	24	24	V *
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	−20 to + 90	°C

MECHANICAL DATA

SOT-115 (see page 2).

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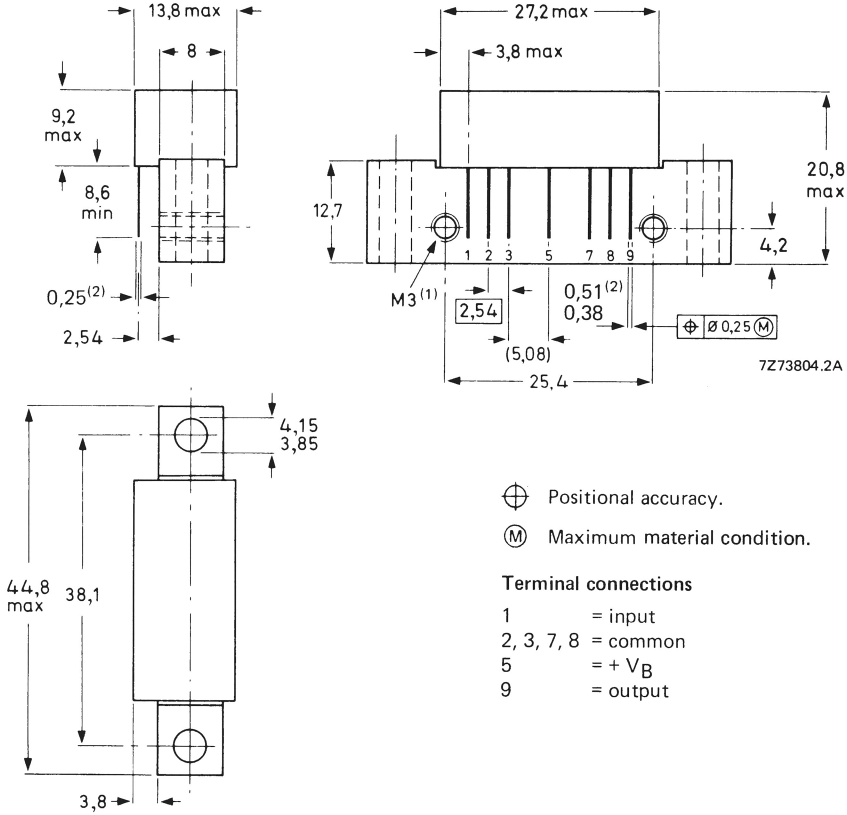
* The modules are able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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8,6 min
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2,54
27,2 max
3,8 max
20,8 max
12,7
4,2
1 2 3 5 7 8 9
M3(1)
2,54
0,51(2)
0,38
(5,08)
25,4
⌖ Ø 0,25 Ⓜ
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

⌖ Positional accuracy.

Ⓜ Maximum material condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

(1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see Accessory).

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	63 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C *

* With a heatsink ⩽ 4,7 K/W for the BGY57, and ⩽ 5,8 K/W for the BGY56 a maximum ambient temperature of + 65 °C is permissible. (K/W is SI unit for °C/W.)

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C			BGY56	BGY57	
Power gain at f = 50 MHz	G_p		22,0 ± 0,6	22,0 ± 0,6	dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to + 1,0	0 to + 1,0	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,2	± 0,2	dB
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		⩾	20	20	dB
Output voltage at d_{im} = −60 dB (DIN 45004 par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	61,5	64	dBmV
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	⩽	−64	−66	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	7	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULE

Hybrid amplifier module intended for CATV systems.

QUICK REFERENCE DATA

Frequency range	f		40 to 300	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	Ω
Power gain at f = 50 MHz	G_p		33,0 ± 1,0	dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,5 to + 1,5	dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,3	dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	20	dB
Output voltage at d_{im} = −60 dB (DIN 45004, par. 6.3: 3-tone)	V_o	⩾	64	dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−68	dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	320	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	°C

MECHANICAL DATA

SOT-115 (see page 2).

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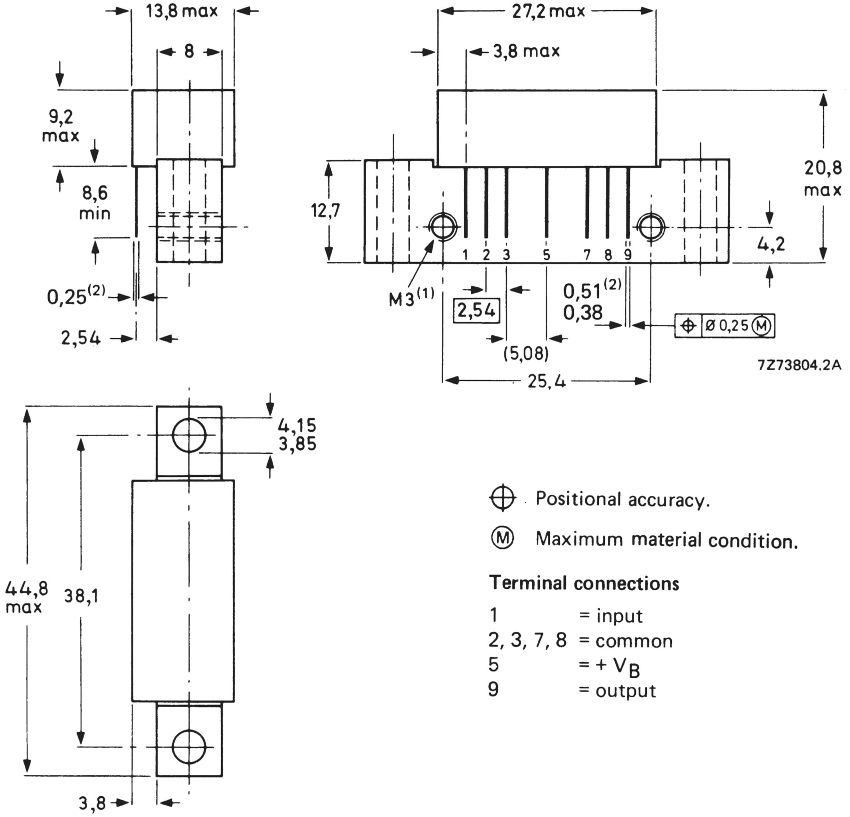
* The module is able to withstand incidental short peaks in the supply voltage up to a maximum of 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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2,54
27,2 max
3,8 max
20,8 max
12,7
4,2
1 2 3 5 7 8 9
M3(1)
2,54
0,51(2)
0,38
⌖ Ø 0,25 Ⓜ
(5,08)
25,4
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

⌖ Positional accuracy.

Ⓜ Maximum material condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

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(1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see Accessory).

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	55 dBmV
Storage temperature	T_{stg}		−40 to +100 °C
Operating mounting base temperature	T_{mb}		−20 to +90 °C *

* With a heatsink ⩽ 3,2 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of + 65 °C is permissible.

CHARACTERISTICS

Supply voltage $V_B = +24$ V; $T_{amb} = 25$ °C

Power gain at f = 50 MHz	G_p		33,0 ± 1,0 dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,5 to + 1,5 dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,3 dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 300 MHz		⩾	20 dB
Output voltage at $d_{im} = -60$ dB (DIN 45004, par. 6.3: 3-tone) $V_p = V_o$; $f_p = 287{,}25$ MHz $V_q = V_o - 6$ dB; $f_q = 294{,}25$ MHz $V_r = V_o - 6$ dB; $f_r = 296{,}25$ MHz Measured at $f_{(p+q-r)} = 285{,}25$ MHz	V_o	⩾	64 dBmV
2nd harmonic distortion $V_p = V_o = 50$ dBmV; $f_p = 66$ MHz $V_q = V_o = 50$ dBmV; $f_q = 144$ MHz Measured at $f_{(p+q)} = 210$ MHz	d_2	⩽	−68 dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6 dB
Total d.c. current consumption	I_{tot}	typ. ⩽	320 mA 340 mA

CATV AMPLIFIER MODULE

Hybrid amplifier module for use as 34 dB line extender in CATV systems operating at frequencies up to 330 MHz.

Features:
- excellent linearity;
- extremely low noise;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

Frequency range	f		40 to 330	MHz
Source impedance and load impedance	$Z_S = Z_L$		75	Ω
Power gain at f = 50 MHz	G_p		34,0 ± 1,0	dB
Slope cable equivalent f = 40 MHz to 330 MHz			0,5 to 1,5	dB
Flatness of frequency response f = 40 MHz to 330 MHz		⩽	± 0,3	dB
Return losses at input and output f = 40 MHz to 330 MHz		⩾	20	dB
Output voltage at d_{im} = –60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	⩾	64	dBmV
2nd order distortion at channel R V_o = 50 dBmV on channel 2 and 13	d_2	⩽	–70	dB
Composite triple beat 32 channels V_o = 46 dBmV		⩽	–67	dB
Output capability X_{mod} = –57 dB; 32 channels flat	V_o	⩾	50	dBmV
Noise figure f = 40 MHz to 330 MHz	F	⩽	6	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	320	mA
Operating mounting base temperature	T_{mb}		–20 to + 90	°C

MECHANICAL DATA

SOT-115 (see Fig. 1).

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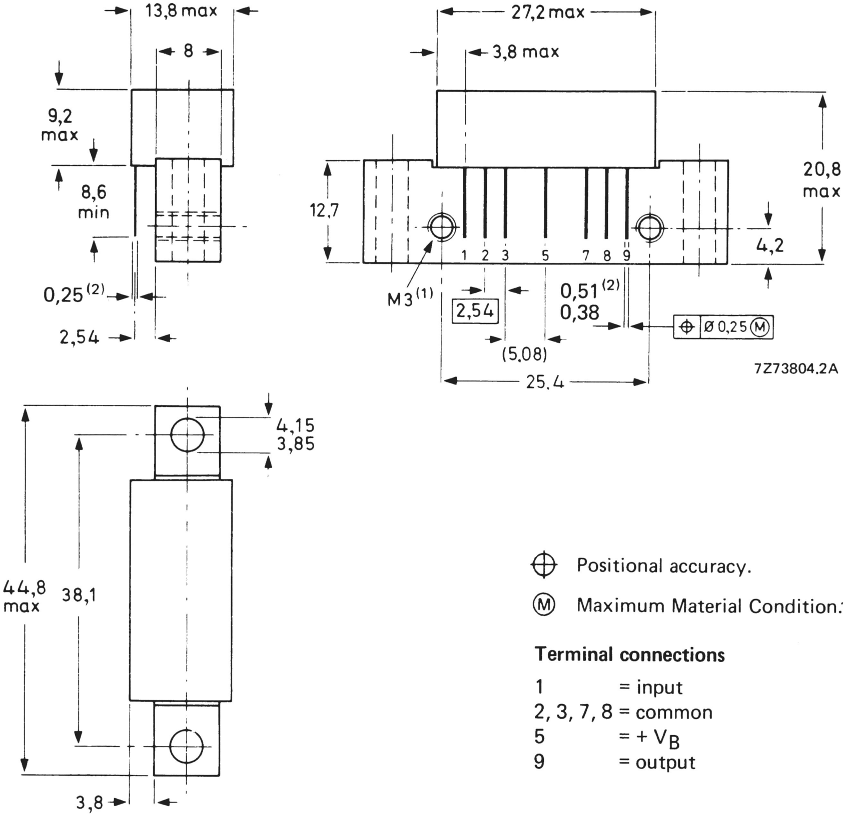
* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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9,2 max
8,6 min
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2,54
27,2 max
3,8 max
20,8 max
12,7
4,2
1 2 3 5 7 8 9
M3 (1)
2,54
0,51 (2)
0,38
⊕ Ø 0,25 Ⓜ
(5,08)
25,4
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

(1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see Accessory).

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	55 dBmV
Storage temperature	T_{stg}		−40 to + 100 °C
Operating mounting base temperature	T_{mb}		−20 to + 90 °C*

* With a heatsink ⩽ 3,2 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of + 65 °C is permissible.

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

Power gain at f = 50 MHz	G_p		34,0 ± 1,0 dB
Slope cable equivalent f = 40 MHz to 330 MHz			0,5 to 1,5 dB
Flatness of frequency response f = 40 MHz to 330 MHz		⩽	± 0,3 dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 330 MHz		⩾	20 dB
Output voltage at d_{im} = −60 dB (DIN 45004, 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o - 6$ dB; f_q = 294,25 MHz $V_r = V_o - 6$ dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	64 dBmV
2nd order distortion V_o = 50 dBmV; channel 2 V_o = 50 dBmV; channel 13 Measured at channel R	d_2	⩽	−70 dB
Composite triple beat 32 channels V_o = 46 dBmV; channel W		⩽	−67 dB
Composite triple beat 40 channels V_o = 46 dBmV; channel W		⩽	−63 dB
Output capability on channel W X_{mod} = −57 dB; 32 channels flat	V_o	⩾	50 dBmV
X_{mod} = −57 dB; 40 channels flat	V_o	⩾	49,5 dBmV
Noise figure f = 40 MHz to 330 MHz	F	⩽	6 dB
Total d.c. current consumption	I_{tot}	typ. ⩽	320 mA 340 mA

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULE

Hybrid amplifier module intended for CATV systems up to 300 MHz.

QUICK REFERENCE DATA

Frequency range	f		40 to 300 MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75 Ω
Power gain at f = 50 MHz	G_p		38,5 ±1,0 dB
Slope cable equivalent f = 40 MHz to 300 MHz			0 to +1,0 dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	± 0,3 dB
Return losses at input and output f = 40 MHz to 300 MHz		⩾	18 dB ←
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6,3: 3-tone)	V_o	⩾	64 dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	⩽	−68 dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6 dB
D.C. supply voltage	$+V_B$	=	24 V*
Total d.c. current consumption at V_B = +24 V	I_{tot}	typ.	320 mA
Operating mounting base temperature	T_{mb}		−20 to +90 °C

MECHANICAL DATA

SOT-115 (see page 2).

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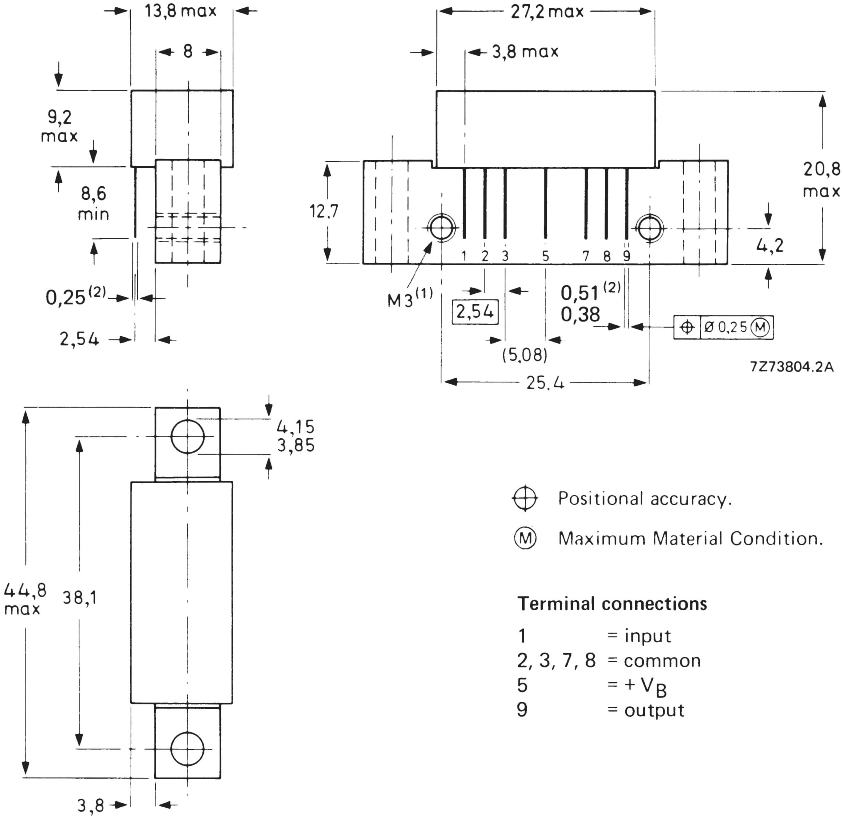
* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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9,2 max
8,6 min
0,25 (2)
2,54
27,2 max
3,8 max
20,8 max
12,7
4,2
1 2 3 5 7 8 9
M3 (1)
2,54
0,51 (2)
0,38
(5,08)
25,4
⌖ Ø 0,25 Ⓜ
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

⌖ Positional accuracy.

Ⓜ Maximum Material Condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

→ (1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see Accessory).

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

DEVELOPMENT SAMPLE DATA

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	53 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C*

* With a heatsink ≤3,2 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of +65 °C is permissible.

CHARACTERISTICS

Supply voltage V_B = +24 V; T_{amb} = 25 °C

Power gain at f = 50 MHz	G_p		38,5 ± 1,0 dB	
Slope cable equivalent f = 40 MHz to 300 MHz			0 to +1,0 dB	
Flatness of frequency response f = 40 MHz to 300 MHz		≤	± 0,3 dB	
Return losses at input and output $Z_S = Z_L$ = 75 Ω; f = 40 MHz to 300 MHz		≥	18 dB	←
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	≥	64 dBmV	
2nd harmonic distortion $V_p = V_o$ = 50 dBmV; f_p = 66 MHz $V_q = V_o$ = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	≤	−68 dB	
Noise figure f = 40 MHz to 300 MHz	F	≤	6 dB	
Total d.c. current consumption	I_{tot}	typ. ≤	320 mA 340 mA	

HYBRID V.H.F. PUSH-PULL AMPLIFIER MODULE

Interstage hybrid amplifier module intended for CATV systems up to 300 MHz. The inputs and outputs of the stages have been terminated separately.

QUICK REFERENCE DATA for total amplifier unless otherwise specified

Frequency range	f		40 to 300		MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75		Ω
Power gain at f = 50 MHz	G_p		33,3 ± 1,0		dB
Slope cable equivalent f = 40 MHz to 300 MHz			+ 0,5 to + 1,5		dB
Flatness of frequency response f = 40 MHz to 300 MHz		≤	± 0,3		dB
			pre-stage	**final stage**	
Return losses at input and output f = 40 MHz to 300 MHz	s_{11}	≥	20	18	dB
	s_{22}	≥	18	20	dB
Output voltage at d_{im} = −60 dB (DIN45004B, par. 6.3: 3-tone)	V_o	≥	64		dBmV
2nd harmonic distortion at V_o = 50 dBmV	d_2	≤	−66		dB
Noise figure f = 40 MHz to 300 MHz	F	≤	6		dB
D.C. supply voltage	$+V_B$	=	24		V*
Total d.c. current consumption at V_B = +24 V	I_{tot}	typ.	320		mA
Operating mounting base temperature	T_{mb}		−20 to +90		°C

MECHANICAL DATA

SOT-115 (see page 2).

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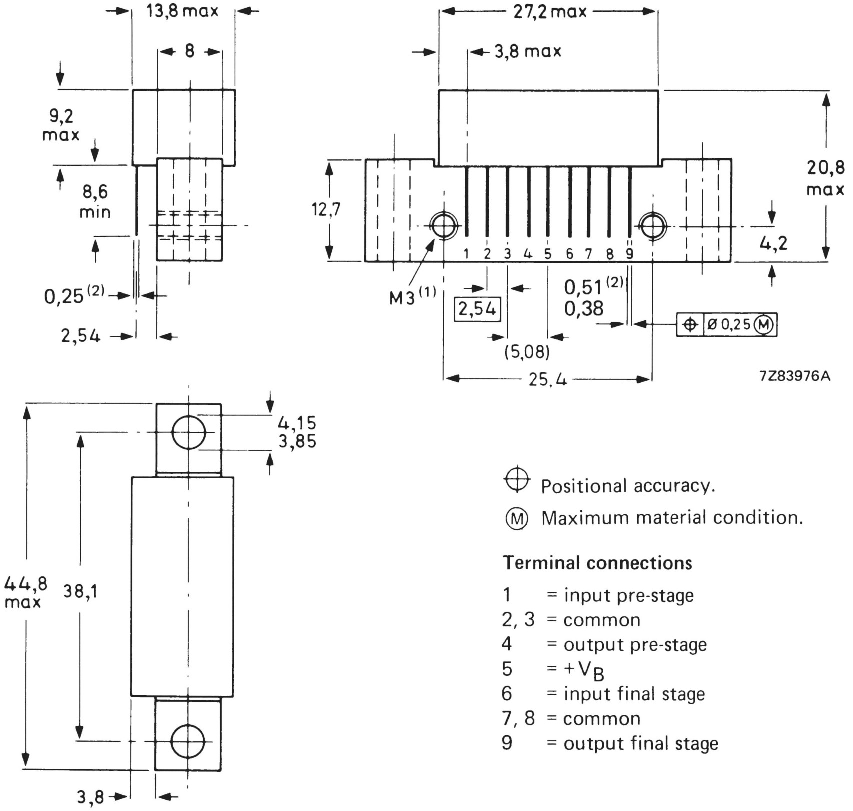
* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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9,2 max
8,6 min
0,25 (2)
2,54
27,2 max
3,8 max
20,8 max
12,7
4,2
1 2 3 4 5 6 7 8 9
M3 (1)
2,54
0,51 (2)
0,38
(5,08)
25,4
⌖ Ø 0,25 Ⓜ
7Z83976A
4,15
3,85
44,8 max
38,1
3,8

⌖ Positional accuracy.

Ⓜ Maximum material condition.

Terminal connections

1 = input pre-stage
2, 3 = common
4 = output pre-stage
5 = $+V_B$
6 = input final stage
7, 8 = common
9 = output final stage

(1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see Accessory).

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage total amplifier	V_i	max.	55	dB/mV
Storage temperature	T_{stg}	−40 to + 100		°C
Operating mounting base temperature	T_{mb}	−20 to +90		°C*

* With a heatsink ⩽3,2 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of +65 °C is permissible.

CHARACTERISTICS for total amplifier unless otherwise specified.

Supply voltage $V_B = +24$ V; $T_{amb} = 25$ °C

				pre-stage	final stage	
Power gain at f = 50 MHz	G_p		33,3 ±1,0			dB
Slope cable equivalent f = 40 MHz to 300 MHz			+0,5 to +1,5			dB
Flatness of frequency response f = 40 MHz to 300 MHz		⩽	±0,3			dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 300 MHz	s_{11}	⩾		20	18	dB
	s_{22}	⩾		18	20	dB
Output voltage at $d_{im} = -60$ dB (DIN45004B, par. 6.3: 3-tone) $V_p = V_o$; $f_p = 287,25$ MHz $V_q = V_o - 6$ dB; $f_q = 294,25$ MHz $V_r = V_o - 6$ dB; $f_r = 296,25$ MHz Measured at $f_{(p+q-r)} = 285,25$ MHz	V_o	⩾	64			dBmV
2nd harmonic distortion $V_p = V_o = 50$ dBmV; $f_p = 66$ MHz $V_q = V_o = 50$ dBmV; $f_q = 144$ MHz Measured at $f_{(p+q)} = 210$ MHz	d_2	⩽	−66			dB
Noise figure f = 40 MHz to 300 MHz	F	⩽	6			dB
Total d.c. current consumption	I_{tot}	typ.	320			mA
		⩽	340			mA

CATV AMPLIFIER MODULE

Hybrid amplifier module for use in CATV systems and operating at frequencies from 5 MHz to 200 MHz. This device is intended as a reverse amplifier for use in two-way systems.

QUIKC REFERENCE DATA

Frequency range	f		5 to 200	MHz
Source impedance and load impedance	$Z_S = Z_L$		75	Ω
Power gain at f = 50 MHz	G_p		13,0 ± 0,5	dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,5 to + 0,2	dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	≤	± 0,25	dB
Return losses at input and output f = 5 MHz to 200 MHz	S_{11-22}	≥	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	≥	64	dBmV
2nd-order distortion V_o = 50 dBmV	d_2	≤	−72	dB
Composite triple beat; 25 channels V_o = 50 dBmV	CTB	typ.	−64	dB
Noise figure f = 200 MHz	F	typ.	7,0	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption V_B = + 24 V	I_{tot}	typ.	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	°C

MECHANICAL DATA

SOT-115 (see Fig. 1).

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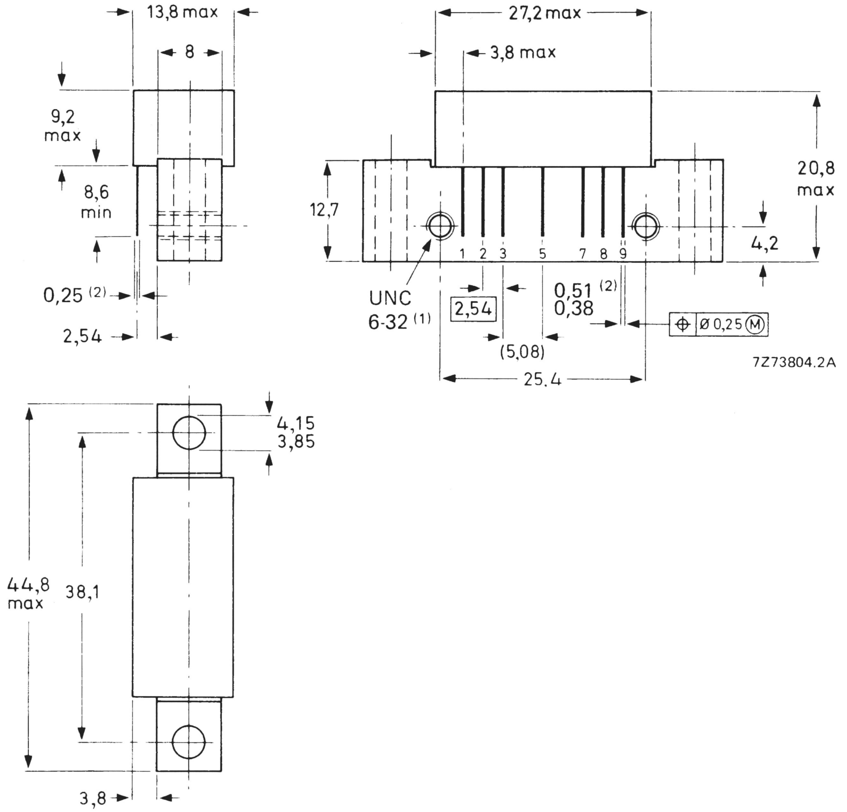
* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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9,2 max
8,6 min
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2,54
27,2 max
3,8 max
20,8 max
12,7
4,2
1 2 3 5 7 8 9
UNC 6-32 (1)
2,54
0,51 (2)
0,38
(5,08)
25,4
⌖ Ø 0,25 Ⓜ
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

(1) Screw 6-32UNC-2A available upon request (see 'Accessory').

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	67 dBmV
Storage temperature	T_{stg}	−40 to +	100 °C
Operating mounting base temperature	T_{mb}	−20 to	+ 90 °C*

* With a heatsink ≤ 4,7 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of + 65 °C is permissible.

CHARACTERISTICS

Supply voltage $V_B = +24$ V; $T_{amb} = 25$ °C

Power gain at f = 50 MHz	G_p		13,0 ± 0,5	dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,5 to +0,2	dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	$\leqslant$	± 0,25	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	$\geqslant$	18	dB
Output voltage at $d_{im} = -60$ dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; $f_p = 187{,}25$ MHz $V_q = V_o - 6$ dB; $f_q = 194{,}25$ MHz $V_r = V_o - 6$ dB; $f_r = 196{,}25$ MHz Measured at $f_{(p+q-r)} = 185{,}25$ MHz	V_o	$\geqslant$	64	dBmV
2nd-order distortion $V_o = 50$ dBmV; $f_p = 66$ MHz $V_o = 50$ dBmV; $f_q = 144$ MHz Measured at $f_{(p+q)} = 210$ MHz	d_2	$\leqslant$	−72	dB
Composite triple beat on 25 channels $V_o = 50$ dBmV; measured on channel 11	CTB	typ.	−64	dB
Noise figure f = 200 MHz	F	typ.	7,0	dB
Total d.c. current consumption	I_{tot}	typ. $\leqslant$	200 230	mA mA

DEVELOPMENT SAMPLE DATA

This information is derived from development samples made available for evaluation. It does not necessarily imply that the device will go into regular production.

CATV AMPLIFIER MODULE

Hybrid amplifier module for use in CATV systems and operating at freqiencies from 5 MHz to 200 MHz. This device is intended as a reverse amplifier for use in two-way systems.

QUICK REFERENCE DATA

Frequency range	f		5 to 200	MHz
Source impedance and load impedance	$Z_S = Z_L$		75	Ω
Power gain at f = 50 MHz	G_p		18,5 ± 0,5	dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,5 to + 0,2	dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	⩽	± 0,25	dB
Return losses at input and output f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	⩾	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	⩾	65	dBmV
2nd-order distortion V_o = 50 dBmV	d_2	⩽	−72	dB
Composite triple beat; 25 channels V_o = 50 dBmV	CTB	typ.	−64	dB
Noise figure f = 200 MHz	F	typ.	6,0	dB
D.C. supply voltage	$+V_B$	=	24	V*
Total d.c. current consumption V_B = + 24 V	I_{tot}	typ.	200	mA
Operating mounting base temperature	T_{mb}		−20 to + 90	°C

MECHANICAL DATA

SOT-115 (see Fig. 1).

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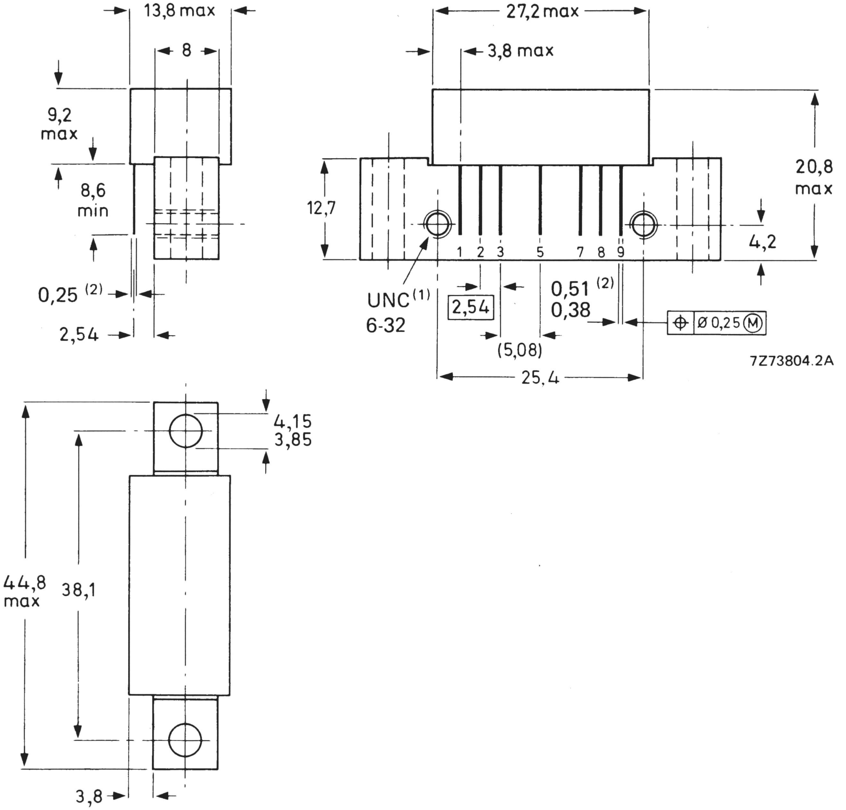
* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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9,2
max
8,6
min
0,25 (2)
2,54
27,2 max
3,8 max
20,8
max
12,7
4,2
1 2 3 5 7 8 9
UNC(1)
6-32
2,54
0,51 (2)
0,38
(5,08)
Ø 0,25 M
25,4
7Z73804.2A
4,15
3,85
44,8
max
38,1
3,8

(1) Screw 6-32UNC-2A available upon request (see 'Accessory').

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}	−40 to + 100	°C
Operating mounting base temperature	T_{mb}	−20 to + 90	°C*

* With a heatsink ⩽ 4,7 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of + 65 °C is permissible.

DEVELOPMENT SAMPLE DATA

CHARACTERISTICS

Supply voltage $V_B = +24$ V; $T_{amb} = 25$ °C

Power gain at f = 50 MHz	G_p		18,5 ± 0,5	dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,5 to +0,2	dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	⩽	± 0,25	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	⩾	18	dB
Output voltage at $d_{im} = -60$ dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 187,25 MHz $V_q = V_o$ −6 dB; f_q = 194,25 MHz $V_r = V_o$ −6 dB; f_r = 196,25 MHz Measured at $f_{(p+q-r)}$ = 185,25 MHz	V_o	⩾	65	dBmV
2nd-order distortion V_o = 50 dBmV; f_p = 66 MHz V_o = 50 dBmV; f_q = 144 MHz Measured at $f_{(p+q)}$ = 210 MHz	d_2	⩽	−72	dB
Composite triple beat on 25 channels V_o = 50 dBmV; measured on channel 11	CTB	typ.	−64	dB
Noise figure f = 200 MHz	F	typ.	6,0	dB
Total d.c. current consumption	I_{tot}	typ.	200	mA
		⩽	230	mA

CATV AMPLIFIER MODULE

Hybrid amplifier module for use in CATV systems and operating at frequencies from 5 MHz to 200 MHz. This device is intended as a reverse amplifier for use in two-way systems.

QUICK REFERENCE DATA

Frequency range	f	5	to	200	MHz
Source impedance and load impedance	$Z_S = Z_L$			75	Ω
Power gain at f = 50 MHz	G_p	22,5	±	0,5	dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L	−0,5	to	+0,2	dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	⩽		±0,25	dB
Return losses at input and output f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	⩾		18	dB
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	⩾		64	dBmV
2nd-order distortion V_o = 50 dBmV	d_2	⩽		−72	dB
Composite triple beat; 25 channels V_o = 50 dBmV	CTB	typ.		−63	dB
Noise figure f = 200 MHz	F	typ.		5,0	dB
D.C. supply voltage	$+V_B$	=		24	V*
Total d.c. current consumption V_B = +24 V	I_{tot}	typ.		200	mA
Operating mounting base temperature	T_{mb}	−20	to	+90	°C

MECHANICAL DATA

SOT-115 (see Fig. 1).

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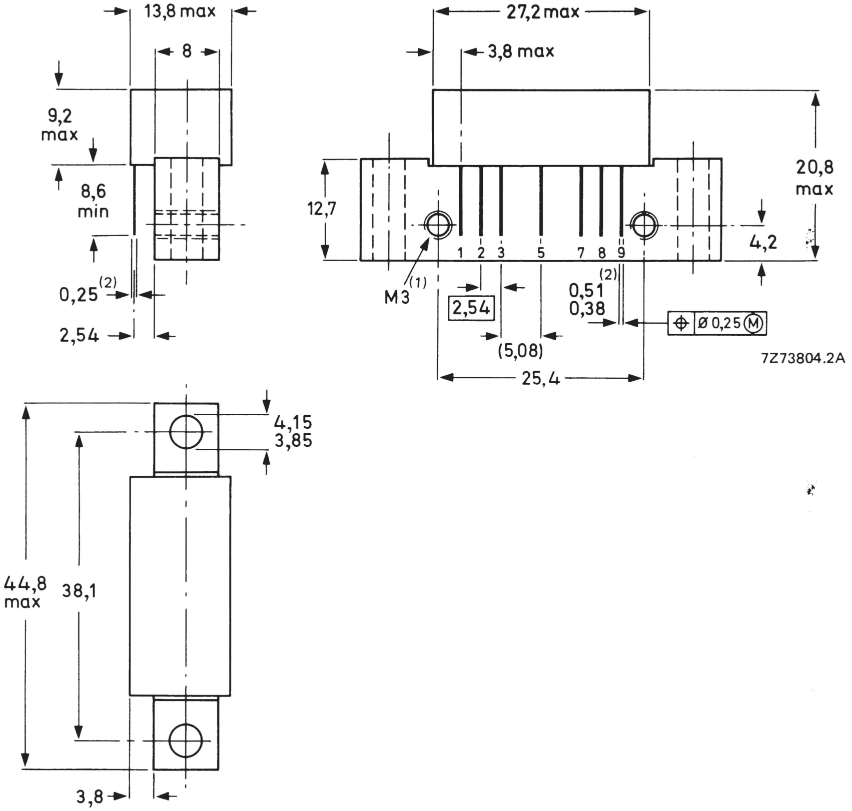
* The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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9,2 max
8,6 min
0,25 (2)
2,54
27,2 max
3,8 max
20,8 max
12,7
4,2
1 2 3 5 7 8 9
M3 (1)
2,54
(2)
0,51
0,38
⌖ Ø 0,25 Ⓜ
(5,08)
25,4
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

(1) Screw 6-32UNC-2A available upon request (see "Accessory").

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	63 dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C*

* With a heatsink ⩽ 4,7 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of +65 °C is permissible.

CHARACTERISTICS

Supply voltage $V_B = +24$ V; $T_{amb} = 25$ °C

Power gain at f = 50 MHz	G_p		22,5 ± 0,5 dB
Slope cable equivalent f = 5 MHz to 200 MHz	S_L		−0,5 to +0,2 dB
Flatness of frequency response f = 5 MHz to 200 MHz	F_L	⩽	± 0,25 dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 5 MHz to 200 MHz	$S_{11\text{-}22}$	⩾	18 dB
Output voltage at $d_{im} = -60$ dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; $f_p = 187{,}25$ MHz $V_q = V_o - 6$ dB; $f_q = 194{,}25$ MHz $V_r = V_o - 6$ dB; $f_r = 196{,}25$ MHz Measured at $f_{(p+q-r)} = 185{,}25$ MHz	V_o	⩾	64 dBmV
2nd-order distortion $V_o = 50$ dBmV; $f_p = 66$ MHz $V_o = 50$ dBmV; $f_q = 144$ MHz Measured at $f_{(p+q)} = 210$ MHz	d_2	⩽	−72 dB
Composite triple beat on 25 channels $V_o = 50$ dBmV; measured on channel 11	CTB	typ.	−63 dB
Noise figure f = 200 MHz	F	typ.	5,0 dB
Total d.c. current consumption	I_{tot}	typ. ⩽	200 mA 230 mA

DEVELOPMENT SAMPLE DATA

CATV AMPLIFIER MODULES

Hybrid amplifier modules for CATV systems operating at frequencies up to 450 MHz.

BGY70: 12,5 dB input amplifier module;
BGY71: 12,5 dB output amplifier module.

Features:

- excellent linearity;
- extremely low noise;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

			BGY70	BGY71	
Frequency range	f		40 to 450	40 to 450	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		12,5 ± 0,4	12,5 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 450 MHz			0,5 to 2	0,5 to 2	dB
Flatness of frequency response f = 40 MHz to 450 MHz		$\leqslant$	± 0,2	± 0,2	dB
Return losses at input and output f = 40 MHz to 450 MHz		$\geqslant$	18	18	dB
Output voltage at d_{im} = –60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	$\geqslant$	62,5	65	dBmV ←
2nd order distortion at channel R V_o = 50 dBmV on channel 2 and 13	d_2	$\leqslant$	–71	–73	dB
Composite triple beat 52 channels V_o = 46 dBmV		$\leqslant$	–55	–59	dB
Output capability X_{mod} = –57 dB; 52 channels flat	V_o	$\geqslant$	46,5	49,5	dBmV
Noise figure f = 40 MHz to 450 MHz	F	$\leqslant$	7,5	8,5	dB
D.C. supply voltage	$+V_B$	=	24	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		–20 to + 90	–20 to + 90	°C

MECHANICAL DATA

SOT-115 (see Fig. 1).

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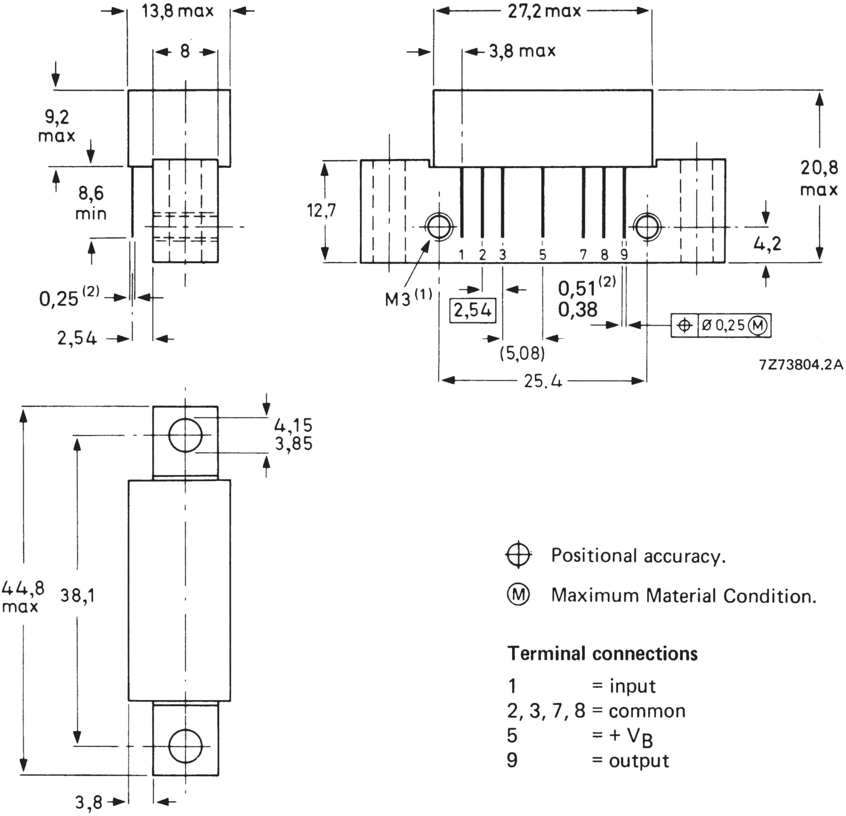
* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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9,2 max
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2,54
27,2 max
3,8 max
12,7
20,8 max
4,2
1 2 3 5 7 8 9
M3 (1)
2,54
0,51 (2)
0,38
(5,08)
25,4
Ø 0,25 Ⓜ
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

(1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see Accessory).

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	67	dBmV
Storage temperature	T_{stg}		−40 to + 100	°C
Operating mounting base temperature	T_{mb}		−20 to + 90	°C*

* With a heatsink ⩽ 4,7 K/W for the BGY71, and ⩽ 5,8 K/W for the BGY70 a maximum ambient temperature of + 65 °C is permissible. (K/W is SI unit for °C/W).

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY70	BGY71	
Power gain at f = 50 MHz	G_p		12,5 ± 0,4	12,5 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 450 MHz			0,5 to 2	0,5 to 2	dB
Flatness of frequency response f = 40 MHz to 450 MHz		⩽	± 0,2	± 0,2	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 450 MHz		⩾	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004B, 6.3: 3-tone) $V_p = V_o$; f_p = 387,25 MHz $V_q = V_o$−6 dB; f_q = 394,25 MHz $V_r = V_o$−6 dB; f_r = 396,25 MHz Measured at $f_{(p+q-r)}$ = 385,25 MHz	V_o	⩾	61	63,5	dBmV
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	62,5	65	dBmV
2nd order distortion V_o = 50 dBmV; channel 2 V_o = 50 dBmV; channel 13 Measured at channel R	d_2	⩽	−71	−73	dB
V_o = 50 dBmV; channel G V_o = 50 dBmV; channel N Measured at channel H 14	d_2	typ.	−68	−70	dB
Composite triple beat 52 channels V_o = 46 dBmV; channel H 14		⩽	−55	−59	dB
Output capability on channel H 14 X_{mod} = −57 dB; 52 channels flat	V_o	⩾	46,5	49,5	dBmV
Noise figure f = 40 MHz to 450 MHz	F	⩽	7,5	8,5	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

CATV AMPLIFIER MODULES

Hybrid amplifier modules for CATV systems operating at frequencies up to 450 MHz.

BGY74: 17 dB input amplifier module;
BGY75: 17 dB output amplifier module.

Features:

- excellent linearity;
- extremely low noise;
- optimal reliability ensured by TiPtAu metallized crystals, silicon nitride passivation and rugged construction.

QUICK REFERENCE DATA

			BGY74	BGY75	
Frequency range	f		40 to 450	40 to 450	MHz
Source impedance and load impedance	$Z_S = Z_L$	=	75	75	Ω
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 450 MHz			0,5 to 1,5	0,5 to 1,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz		⩽	± 0,1	± 0,1	dB
Return losses at input and output f = 40 MHz to 450 MHz		⩾	18	18	dB
Output voltage at d_{im} = –60 dB (DIN 45004B, par. 6.3: 3-tone)	V_o	⩾	62,5	65	dBmV
2nd order distortion at channel R V_o = 50 dBmV on channel 2 and 13	d_2	⩽	–71	–73	dB
Composite triple beat 52 channels V_o = 46 dBmV		⩽	–56	–60	dB
Output capability X_{mod} = –57 dB; 52 channels flat	V_o	⩾	46,5	49,5	dBmV
Noise figure f = 40 MHz to 450 MHz	F	⩽	7	7,5	dB
D.C. supply voltage	$+V_B$	=	24	24	V*
Total d.c. current consumption at V_B = + 24 V	I_{tot}	typ.	160	200	mA
Operating mounting base temperature	T_{mb}		–20 to + 90	–20 to + 90	°C

MECHANICAL DATA

SOT-115 (see Fig. 1).

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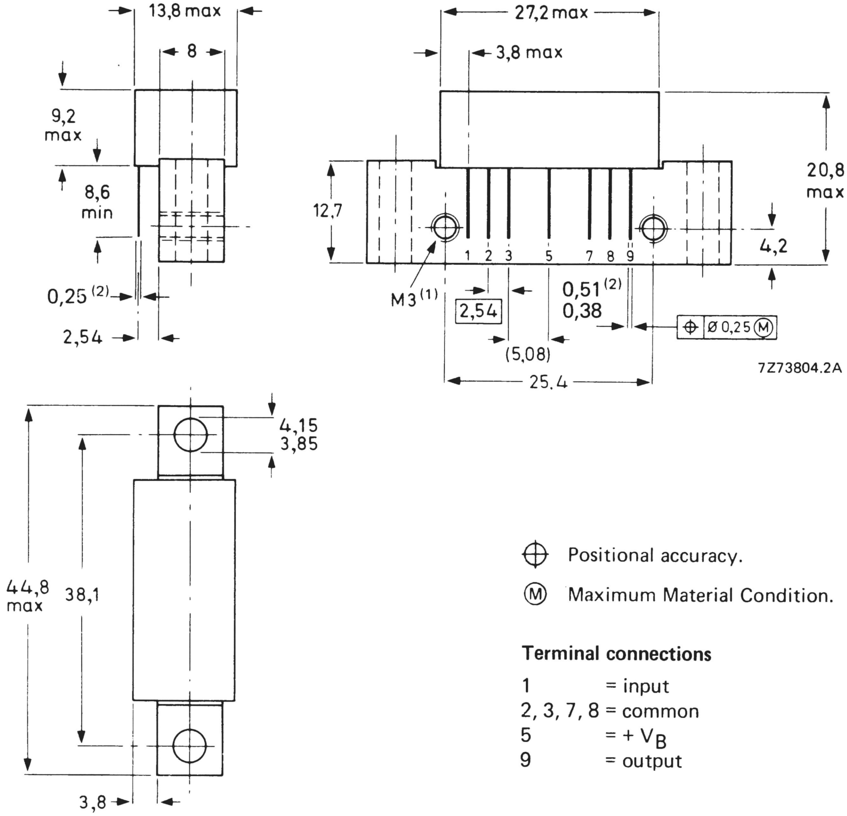
* The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.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8,6 min
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27,2 max
3,8 max
20,8 max
12,7
4,2
1 2 3 5 7 8 9
M3 (1)
2,54
0,51 (2)
0,38
(5,08)
25,4
⌖ Ø 0,25 Ⓜ
7Z73804.2A
4,15
3,85
44,8 max
38,1
3,8

⌖ Positional accuracy.

Ⓜ Maximum Material Condition.

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = + V_B
9 = output

→ (1) Will become 6-32UNC-2B in the course of 1983. Screw 6-32UNC-2A available upon request (see Accessory).

(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max.	65 dBmV
Storage temperature	T_{stg}		−40 to + 100 °C
Operating mounting base temperature	T_{mb}		−20 to + 90 °C*

* With a heatsink ⩽ 4,7 K/W for the BGY75, and ⩽ 5,8 K/W for the BGY74 a maximum ambient temperature of + 65 °C is permissible. (K/W is SI unit for °C/W).

CHARACTERISTICS

Supply voltage V_B = + 24 V; T_{amb} = 25 °C

			BGY74	BGY75	
Power gain at f = 50 MHz	G_p		17,0 ± 0,4	17,0 ± 0,4	dB
Slope cable equivalent f = 40 MHz to 450 MHz			0,5 to 1,5	0,5 to 1,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz		⩽	± 0,1	± 0,1	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 450 MHz		⩽	18	18	dB
Output voltage at d_{im} = −60 dB (DIN 45004B, 6.3: 3-tone) $V_p = V_o$; f_p = 387,25 MHz $V_q = V_o$−6 dB; f_q = 394,25 MHz $V_r = V_o$−6 dB; f_r = 396,25 MHz Measured at $f_{(p+q-r)}$ = 385,25 MHz	V_o	⩾	61	63,5	dBmV
Output voltage at d_{im} = −60 dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; f_p = 287,25 MHz $V_q = V_o$ −6 dB; f_q = 294,25 MHz $V_r = V_o$ −6 dB; f_r = 296,25 MHz Measured at $f_{(p+q-r)}$ = 285,25 MHz	V_o	⩾	62,5	65	dBmV
2nd order distortion V_o = 50 dBmV; channel 2 V_o = 50 dBmV; channel 13 Measured at channel R	d_2	⩽	−71	−73	dB
V_o = 50 dBmV; channel G V_o = 50 dBmV; channel N Measured at channel H 14	d_2	typ.	−68	−70	dB
Composite triple beat 52 channels V_o = 46 dBmV; channel H 14		⩽	−56	−60	dB
Output capability on channel H 14 X_{mod} = −57 dB; 52 channels flat	V_o	⩾	46,5	49,5	dBmV
Noise figure f = 40 MHz to 450 MHz	F	⩽	7	7,5	dB
Total d.c. current consumption	I_{tot}	typ.	160	200	mA
		⩽	180	220	mA

CATV AMPLIFIER MODULE

Hybrid amplifier module for use as 34 dB line extender in CATV systems operating at frequencies up to 450 MHz.

Features:

- excellent linearity;
- extremely low noise;
- optimum reliability ensured by TiPtAu metallized crystals, silicon nitride glass barrier and rugged construction.

QUICK REFERENCE DATA

Frequency range	f	40	to	450	MHz
Source impedance and load impedance	$Z_S = Z_L$			75	Ω
Power gain at f = 50 MHz	G_p	34,0	±	1,0	dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L	0,5	to	2,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz	F_L	$\leqslant$		± 0,3	dB
Return losses at input and output f = 40 MHz to 450 MHz	S_{11-22}	$\geqslant$		18	dB
Output voltage at $d_{im} = -60$ dB (DIN 45004, par. 6.3: 3-tone)	V_o	$\geqslant$		63,5	dBmV
2nd-order distortion at channel R V_o = 50 dBmV on channels 2 and 13	d_2	$\leqslant$		−70	dB
Composite triple beat; 52 channels V_o = 46 dBmV	CTB	$\leqslant$		−59	dB
Output capability Xmod = −57 dB; 52 channels flat	V_o	$\geqslant$		47	dBmV
Noise figure f = 40 MHz to 450 MHz	F	$\leqslant$		6	dB
D.C. supply voltage	$+V_B$	=		24	V*
Total d.c. current consumption V_B = +24 V	I_{tot}	typ.		320	mA
Operating mounting base temperature	T_{mb}	−20	to	+90	°C

MECHANICAL DATA

SOT-115 (see Fig. 1).

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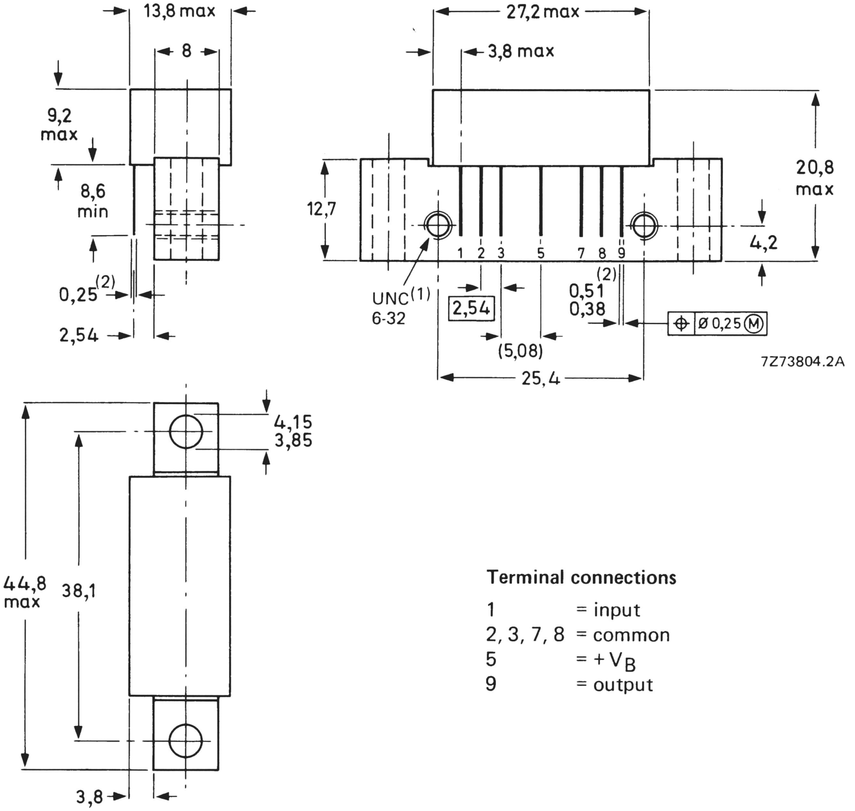
* The module normally operates at V_B = 24 V, but is able to withstand incidental supply transients up to 30 V.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-115.


13,8 max
8
9,2 max
8,6 min
0,25(2)
2,54
27,2 max
3,8 max
20,8 max
12,7
4,2
1 2 3 5 7 8 9
UNC(1) 6-32
2,54
(2) 0,51 0,38
Ø 0,25 Ⓜ
(5,08)
25,4
7Z73804.2A
4,15 3,85
44,8 max
38,1
3,8

Terminal connections

1 = input
2, 3, 7, 8 = common
5 = $+V_B$
9 = output

(1) Screw 6-32UNC-2A available upon request (see Accessory).
(2) Leads available in gold-plated and tin-plated execution.

Soldering recommendations

The maximum permissible temperature of the soldering iron is 260 °C for a contact time of maximum 3 s, when the soldered joints are 3 mm or more from the module.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

R.F. input voltage	V_i	max. 55	dBmV
Storage temperature	T_{stg}	−40 to +100	°C
Operating mounting base temperature	T_{mb}	−20 to +90	°C*

* With a heatsink ⩽ 3,2 K/W (K/W is SI unit for °C/W) a maximum ambient temperature of +65 °C is permissible.

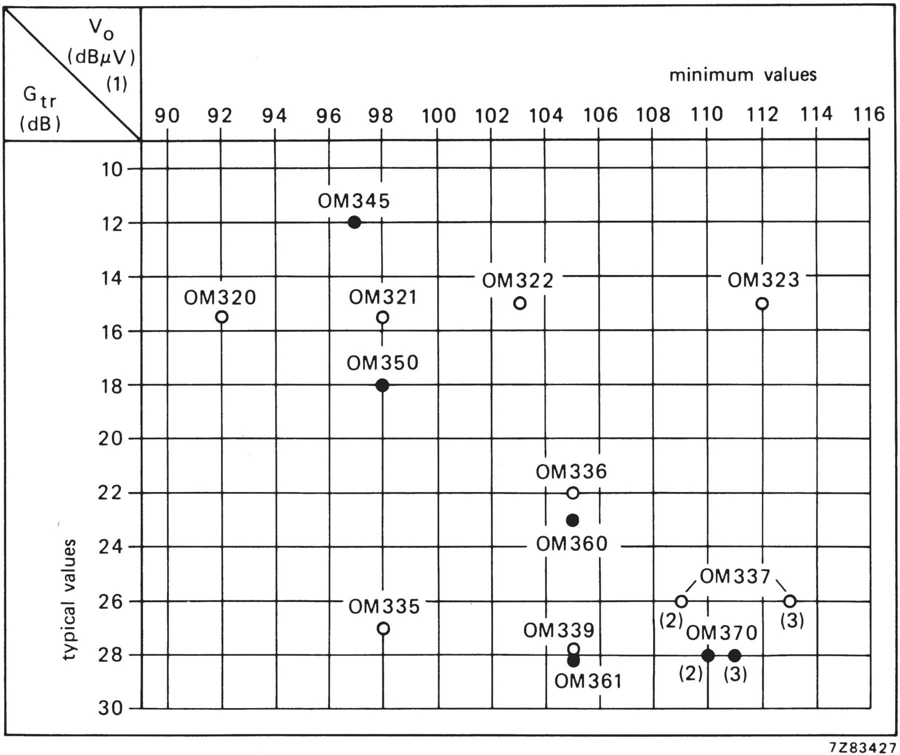
CHARACTERISTICS

Supply voltage $V_B = +24$ V; $T_{amb} = 25$ °C					
Power gain at f = 50 MHz	G_p	34,0	±	1,0	dB
Slope cable equivalent f = 40 MHz to 450 MHz	S_L	0,5	to	2,5	dB
Flatness of frequency response f = 40 MHz to 450 MHz	F_L	≤	±	0,3	dB
Return losses at input and output $Z_S = Z_L = 75\ \Omega$; f = 40 MHz to 450 MHz	$S_{11\text{-}22}$	≥		18	dB
Output voltage at $d_{im} = -60$ dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; $f_p = 387{,}25$ MHz $V_q = V_o - 6$ dB; $f_q = 394{,}25$ MHz $V_r = V_o - 6$ dB; $f_r = 396{,}25$ MHz Measured at $f_{(p+q-r)} = 385{,}25$ MHz	V_o	≥		62	dBmV
Output voltage at $d_{im} = -60$ dB (DIN 45004B, par. 6.3: 3-tone) $V_p = V_o$; $f_p = 287{,}25$ MHz $V_q = V_o - 6$ dB; $f_q = 294{,}25$ MHz $V_r = V_o - 6$ dB; $f_r = 296{,}25$ MHz Measured at $f_{(p+q-r)} = 285{,}25$ MHz	V_o	≥		63,5	dBmV
2nd-order distortion $V_o = 50$ dBmV; channel 2 $V_o = 50$ dBmV; channel 13 Measured at channel R	d_2	≤		−70	dB
$V_o = 50$ dBmV; channel G $V_o = 50$ dBmV; channel N Measured at channel H14	d_2	typ.		−67	dB
Composite triple beat 52 channels $V_o = 46$ dBmV; channel H14	CTB	≤		−59	dB
Output capability on channel H14 Xmod = −57 dB; 52 channels flat	V_o	≥		47	dBmV
Noise figure f = 40 MHz to 450 MHz	F	≤		6	dB
Total d.c. current consumption	I_{tot}	typ. ≤		320 340	mA mA

WIDEBAND AMPLIFIERS (V.H.F. & U.H.F.)

Selection guide

HYBRID ICs FOR WIDE-BAND AMPLIFIERS



● 12 V types

○ 24 V types

(1) At −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone).

(2) UHF.

(3) VHF.

Fig. 1 Type/performance in matrix survey.

The matrix survey (Fig. 1) and the tables next page show both the 12 V and 24 V ranges.

Note that the modules are available in the combination of high gain- high output voltage.

Tables of VHF/UHF hybrid ICs for wide-band amplifiers

12 V supply voltage

	type	stages	gain (dB)	$V_{o(rms)}$ (dBμV) −60 dB IMD (note 1) min. values	noise figure (dB)	max. VSWR typ. values (note 2)		supply current (mA)
						input	output	
low medium	OM345	1	12	97	5,5	2,0	1,4	11,5
	OM350	2	18	98	6,0	1,5	1,9	18
medium output	OM360	3	23	105	7,0	1,3	1,5	55
	OM361	3	28	105	6,0	1,5	1,7	50
high output	OM370	3	28	111	7,0	2,3	1,9	105

24 V supply voltage

	type	stages	gain (dB)	$V_{o(rms)}$ (dBμV) −60 dB IMD (note 1) min. values	noise figure (dB)	max. VSWR typ. values (note 2)		supply current (mA)
						input	output	
low output	OM320	2	15,5	92	5,5	2,2	2,5	23
	OM321	2	15,5	98	6,0	2,5	2,0	33
	OM335	3	27	98	5,5	1,9	3,2	35
medium output	OM322	2	15	103	7,0	1,7	1,7	60
	OM336	3	22	105	7,0	1,4	1,6	65
	OM339	3	28	105	6,0	1,5	1,5	66
high output	OM323*	2	15	112	9,0	1,9	2,3	100
	OM337*	3	26	113	9,8	2,3	1,8	115

* Also available in A-version for external coil and output capacitor.

Notes

1. Measured at −60 dB intermodulation distortion to DIN 45004, par. 6.3: 3-tone, f = 470 MHz.
2. The typical maximum VSWR occurring in the frequency range 40-860 MHz, for a sample connected to a 75 Ω line.

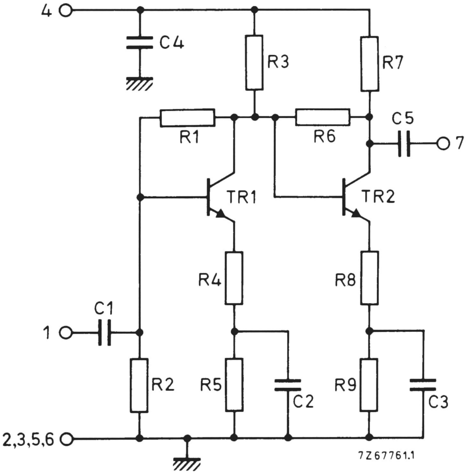
HYBRID VHF/UHF WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster amplifiers, as pre-amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	15,5	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	92	dBμV
Noise figure	F	typ.	5,5	dB
D.C. supply voltage	V_B	=	24	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}		−20 to +70	^oC
Storage temperature	T_{stg}		−40 to +125	^oC
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M} $-V_{1M}, V_{7M}$	max. max.	28 10	V V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	^oC
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f		40 to 860	MHz

Performance

Supply current	I_B	typ.	23	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	 typ.	13 to 18 15, 5	dB dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2, 2	**
output	$VSWR_{(o)}$	typ.	2, 5	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	30	dB
f = 860 MHz	$\|s_r\|^2$	typ.	24	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	> typ.	92 94	dBμV dBμV
Noise figure	F	typ.	5, 5	dB

s-parameters	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

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* This socket can be made available for customer reference purposes.

** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

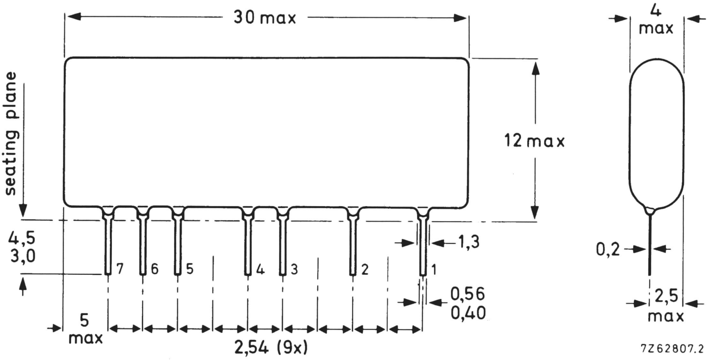
Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	24	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated.


30 max
seating plane
12 max
4,5
3,0
7
6
5
4
3
2
1
1,3
0,56
0,40
5
max
2,54 (9x)
4
max
0,2
2,5
max
7Z62807.2

Terminal connections

1	= Input
2, 3, 5, 6	= Common
4	= Supply (+)
7	= Output

Soldering recommendations

Hand soldering

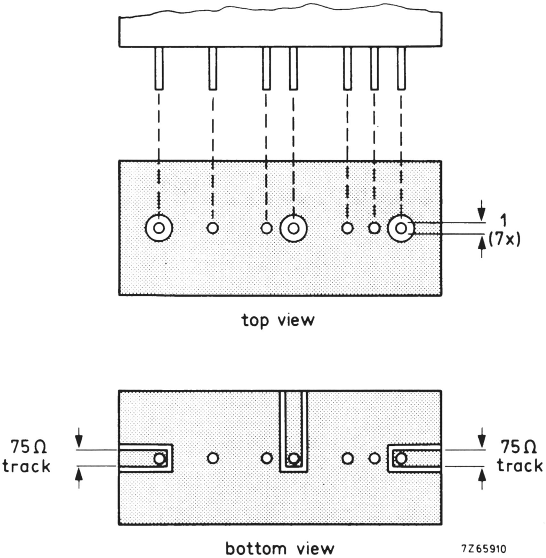
Maximum contact time for a soldering-iron temperature of 260 °C; up to seating plane: 5 s

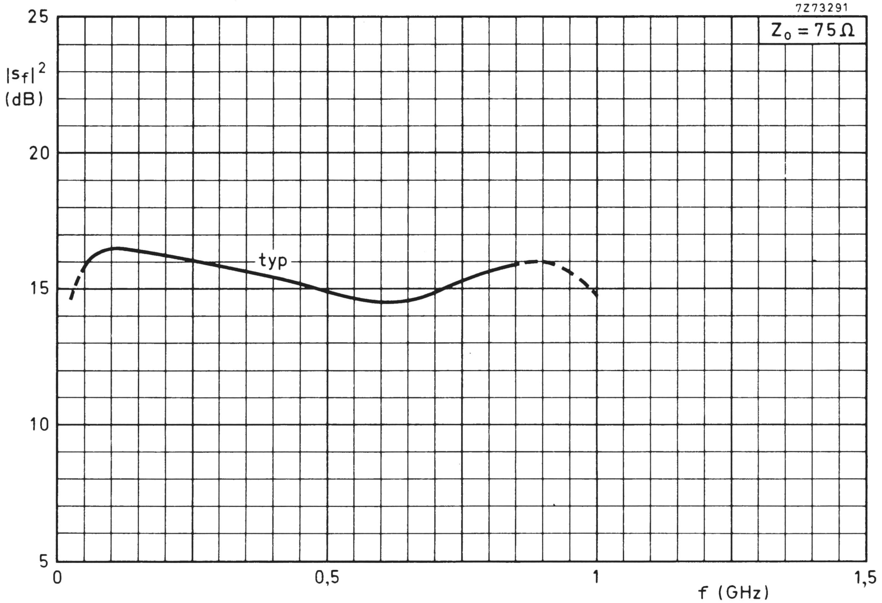
Dip or wave soldering

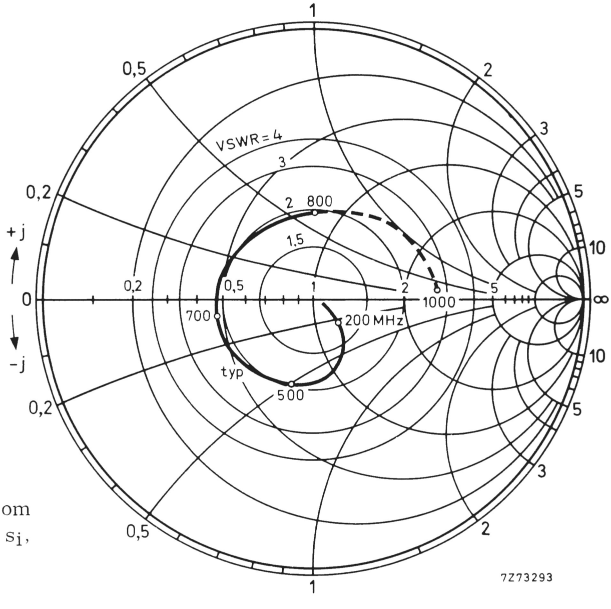
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

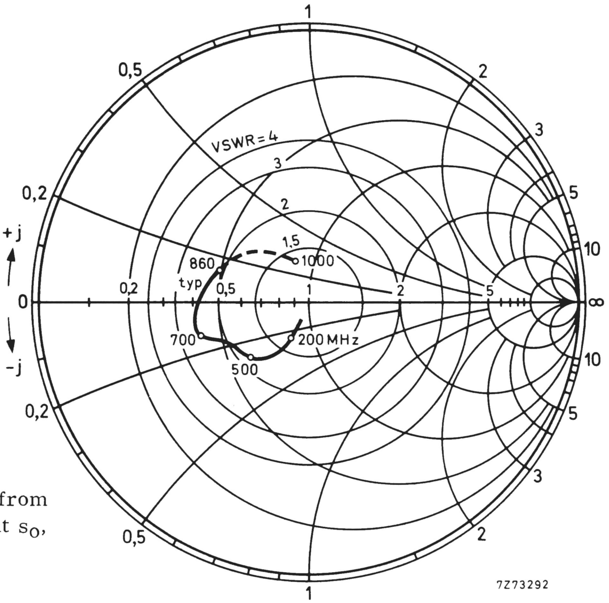
The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.
Input and output should be connected to 75 Ω tracks.
The connections to the "common" pins should be as close to the seating plane as possible.







Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75.



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75.

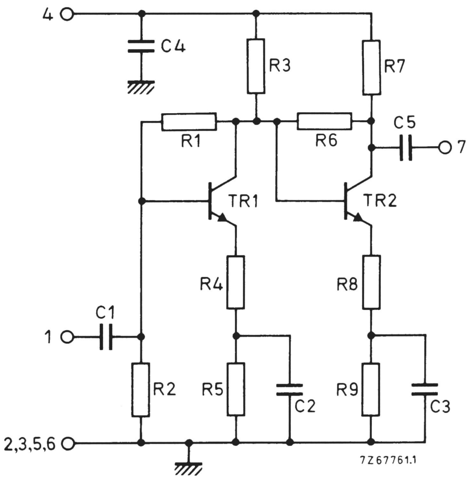
HYBRID VHF/UHF WIDE BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster-amplifiers, as pre-amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	15,5	dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	98	dBμV
Noise figure	F	typ.	6	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to + 70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}$, $-V_{7M}$	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	33	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$		13 to 18	dB
		typ.	15,5	dB
Flatness of frequency response	$\pm\Delta \lvert s_f \rvert^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,5	**
output	$VSWR_{(o)}$	typ.	2,0	**
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	30	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	26	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	98	dBμV
		typ.	100	dBμV
Noise figure	F	typ.	6	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

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* This socket can be made available for customer reference purposes.

** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

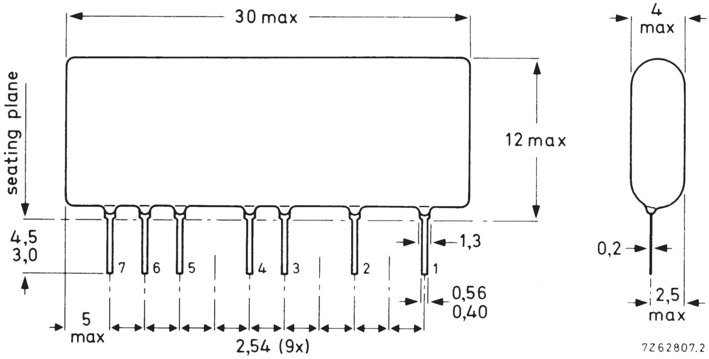
Ambient temperature range	T_{amb}		−20 to + 70	°C
D.C. supply voltage	V_B	=	24	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated.



30 max
seating plane
12 max
4,5
3,0
1,3
7
6
5
4
3
2
1
0,56
0,40
5
max
2,54 (9x)
4
max
0,2
2,5
max
7Z62807.2

Terminal connections

1 = Input
2, 3, 5, 6 = Common
4 = Supply (+)
7 = Output

Soldering recommendations

Hand soldering

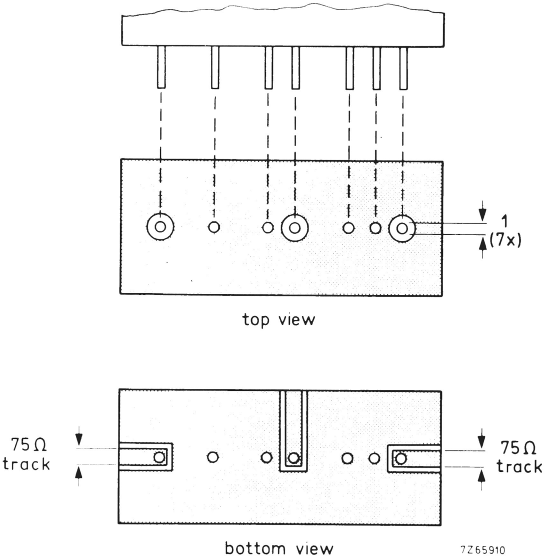
Maximum contact time for a soldering-iron temperature of 260 °C; up to seating plane :	5 s

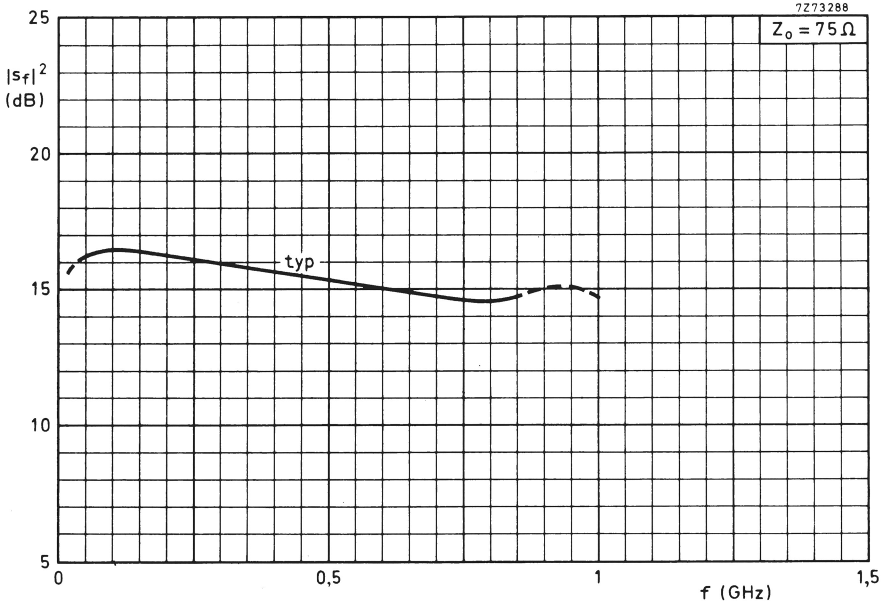
Dip or wave soldering

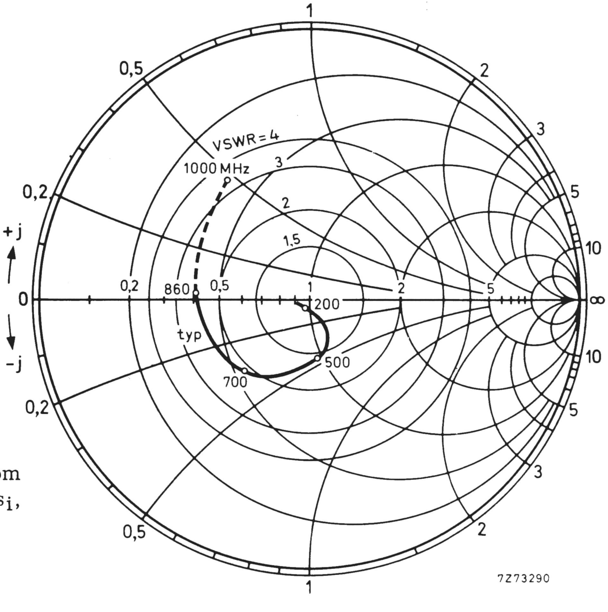
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

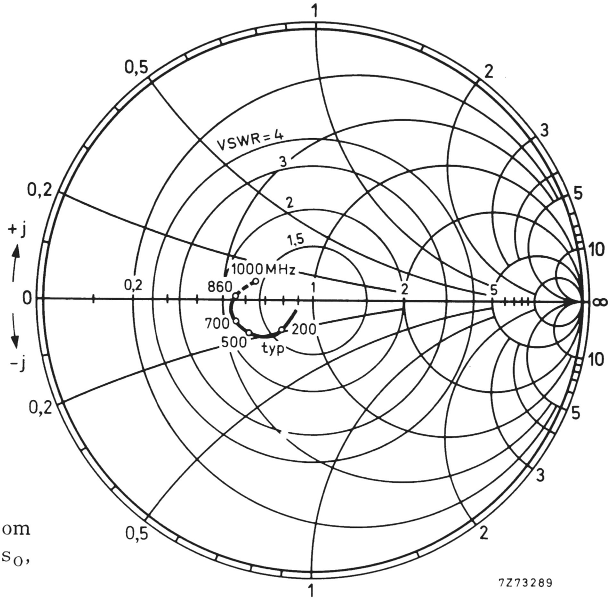
The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.
Input and output should be connected to 75 Ω tracks.
The connections to the "common" pins should be as close to the seating plane as possible.







Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75.



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75.

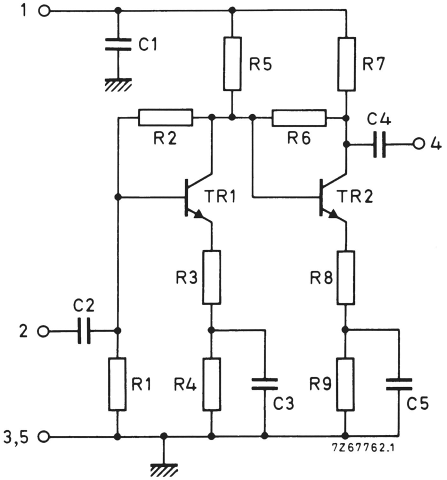
HYBRID VHF/UHF WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use as distribution amplifier in MATV and CATV systems and as general-purpose amplifier for v.h.f. and u.h.f. applications. Except for the encapsulation coating, the OM322 and OM175 have the same specification. OM322 will replace OM175.

QUICK REFERENCE DATA				
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_O$		75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	15	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	0, 3	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	103	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 5-lead, resin coated body on metal base, see MECHANICAL DATA

CIRCUIT DIAGRAM



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Operating ambient temperature	T_{amb}		−20 to +70	°C
Operating mounting-base temperature	T_{mb}	max.	100	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 2 and 4	V_{2M}, V_{4M}	max.	28	V
	$-V_{2M}$, $-V_{4M}$	max.	10	V
Peak incident powers on pins 2 and 4	P_{I2M}, P_{I4M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	60	mA	
Transducer gain	$G_{tr} = \|s_f\|^2$		14 to 16	dB	
		typ.	15	dB	
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	0,3	dB	
		<	0,5	dB	
Individual maximum v.s.w.r.					
input	$VSWR_{(i)}$	typ.	1,7		1)
output	$VSWR_{(o)}$	typ.	1,7		1)
Back attenuation					
f = 100 MHz	$\|s_r\|^2$	typ.	31	dB	
f = 860 MHz	$\|s_r\|^2$	typ.	25	dB	
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	103	dBμV	
		typ.	105	dBμV	
Noise figure	F	typ.	7	dB	

s-parameters:		
	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

---

1) Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

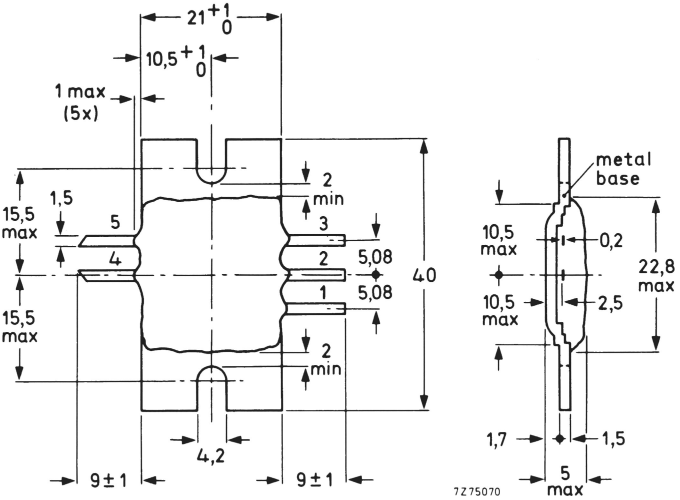
Ambient temperature range	T_{amb}	-20 to +70	°C
D.C. supply voltage	V_B	= 24	V ±10%
Frequency range	f	40 to 860	MHz
Source impedance and load impedance	R_S, R_ℓ	= 75	Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated and mounted on a metal mounting base.



21 +1 0
10,5 +1 0
1 max (5x)
1,5
15,5 max
15,5 max
5
4
3
2
1
2 min
2 min
5,08
5,08
40
4,2
9±1
9±1
metal base
10,5 max
10,5 max
0,2
2,5
22,8 max
1,7
1,5
5 max
7Z75070

Terminal connections

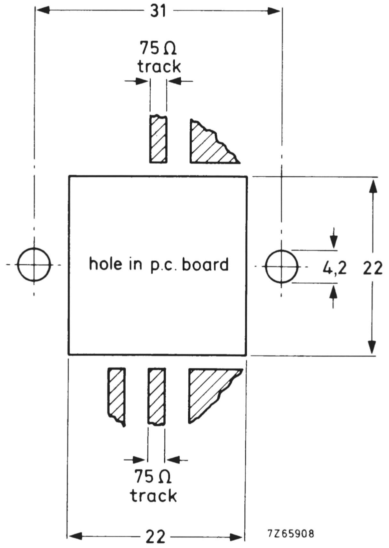
1 = Supply (+)
2 = Input
3 and 5 = Common (internally connected to metal base)
4 = Output

Soldering recommendations

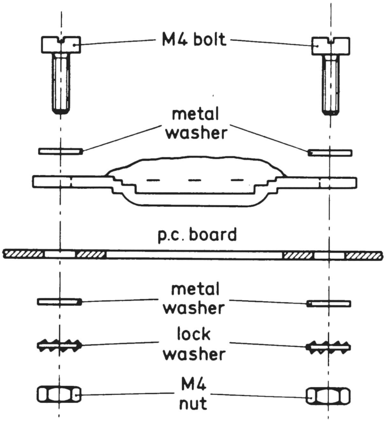
Maximum contact time for a soldering-iron temperature of 260 °C	5	s

Mounting recommendations

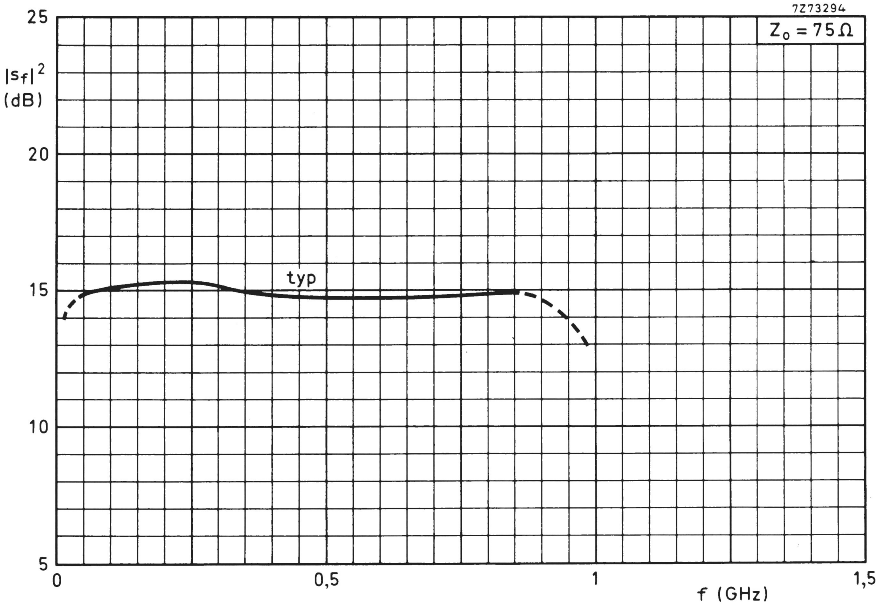
The module should preferably be mounted on a double-sided printed-circuit board, see the examples shown below. Input and output should be connected to 75 Ω tracks.

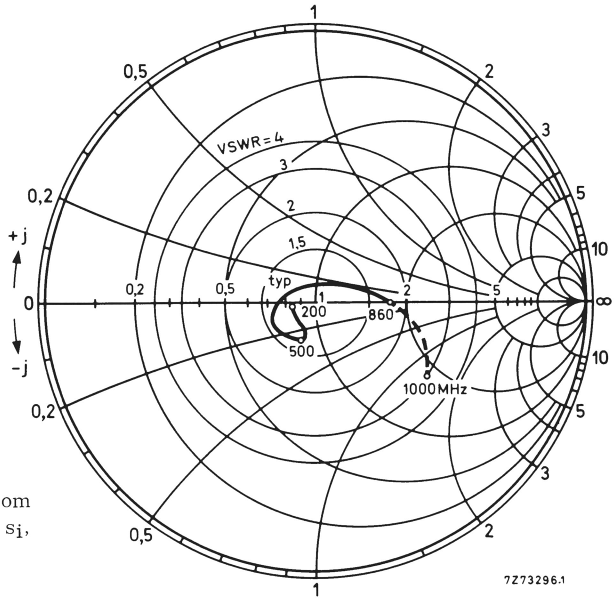

31
75 Ω
track
hole in p.c. board
4,2
22
75 Ω
track
22

7Z65908

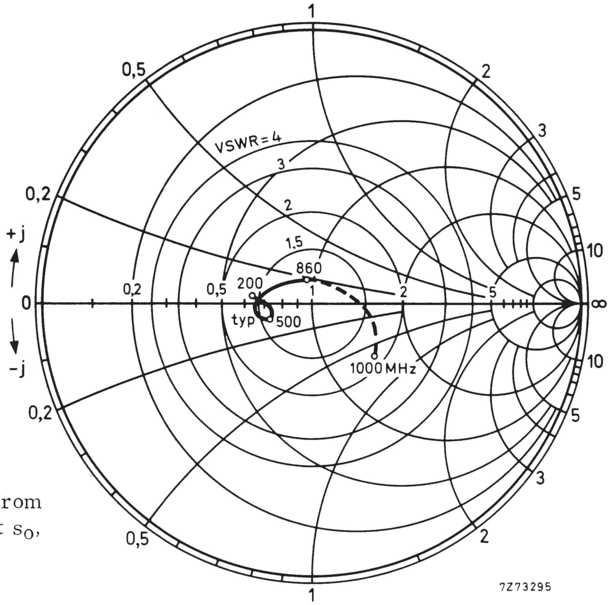

M4 bolt
metal
washer
p.c. board
metal
washer
lock
washer
M4
nut

7Z75071





Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75



Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75

HYBRID V.H.F./U.H.F. WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in the hybrid technique, designed for use in MATV systems, and as general purpose amplifier for v.h.f. and u.h.f. applications requiring a high output level.
The OM323A needs an external collector-coil and blocking capacitor, whereas, the OM323 has these components built-in.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ	15	dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ	0,5	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone); f = 470 MHz	$V_{o(rms)}$	typ	113	dBμV
Noise figure	F	typ	9	dB
D.C. supply voltage	V_B	=	24	V ± 10%
Operating mounting-base temperature	T_{mb}		−30 to +100	°C

ENCAPSULATION 9-pin, in-line, resin-coated body on a right-angled metal mounting tab, see MECHANICAL DATA

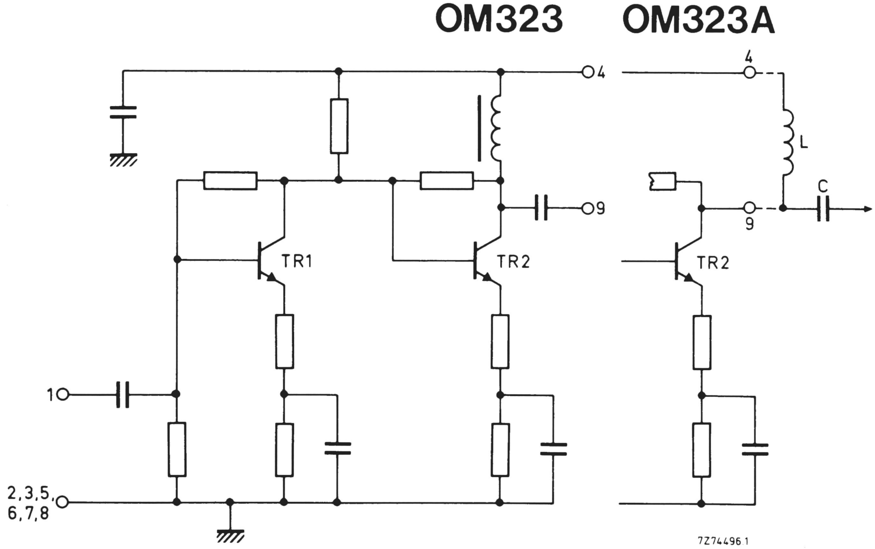


Fig. 1 Circuit diagram.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Operating mounting-base temperature	T_{mb}		−30 to +100	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max	28	V
Peak voltages on pin 1	V_{1M}	max	28	V
	$-V_{1M}$	max	24	V
Peak voltages on pin 9	V_{9M}	max	28	V
	$-V_{9M}$	max	4	V
Peak incident powers on pins 1 and 9	P_{I1M}, P_{I9M}	max	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.—U.H.F. test socket	catalogue no. 3504 110 01830 *			
Mounting base temperature	T_{mb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B		95 to 105	mA
		typ	100	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		14 to 17	dB
		typ	15	dB
Flatness of frequency response	$\pm\Delta\ \|s_f\|^2$	typ	0,5	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ	1,9	**
output	$VSWR_{(o)}$	typ	2,3	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ	29	dB
f = 650 MHz	$\|s_r\|^2$	typ	25,5	dB
f = 860 MHz	$\|s_r\|^2$	typ	24	dB

---

* This socket can be made available for customer reference purposes.

** Highest value, for a sample, occurring in the frequency range.

Output voltage			
at −60 dB intermodulation distortion			
(DIN45004, par. 6.3: 3-tone)			
f = 40–230 MHz	$V_{o(rms)}$	>	112 dBμV
		typ	114 dBμV
f = 470 MHz	$V_{o(rms)}$	typ	113 dBμV
f = 860 MHz	$V_{o(rms)}$	typ	112 dBμV
Noise figure			
channel 2	F	typ	8 dB
channel 65	F	typ	9 dB

s-parameters: $s_f = s_{21}$ $s_i = s_{11}$

$s_r = s_{12}$ $s_o = s_{22}$

OPERATING CONDITIONS

Mounting-base temperature range	T_{mb}		−30 to +100 °C
D.C. supply voltage	V_B	=	24 V ± 10%
Frequency range	f		40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	=	75 Ω

THERMAL DATA

a. The maximum permissible temperature at the mounting base is 100 °C.

b. When the mounting tab is screwed to a double-sided printed-circuit board with dimensions 37 mm x 51 mm, its temperature will be 57 °C above the temperature of the surrounding free air.

c. When a heatsink is fixed to the mounting tab and the pins are soldered into a double-sided printed-circuit board with dimensions 37 mm x 51 mm, the tab will reach the temperatures stated in the following table.

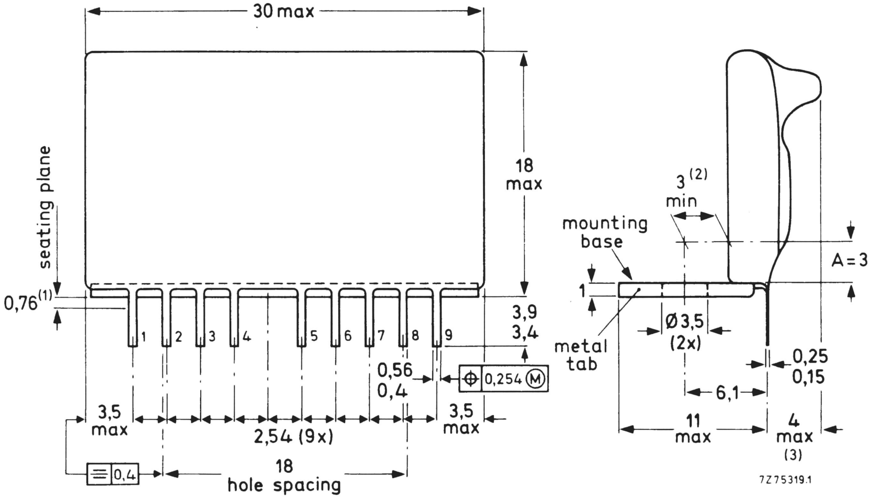
Notes

1. When the device is fixed only to a heatsink, not to a printed-circuit board, the values of the second column of the table should be increased by 2 °C and those of the third column decreased by 2 °C.
2. The user is free to realize proper cooling by using differently shaped sinks, or, preferably, by fixing the tab to any convenient part of the equipment (e.g. a wall of the metal cabinet).

heatsink data thickness 1 mm	$T_{mb} - T_{amb}$ °C	$T_{amb\ max}$ °C
Bright aluminium heatsink		
L-shaped bar, length 100 mm, height 165 mm	24	76
Blackened aluminium heatsink		
L-shaped bar; length 50 mm, height 70 mm	23	77

MECHANICAL DATA Dimensions in mm

The amplifier is resin coated and has a metal mounting tab at a right angle to the encapsulation part.


30 max
18 max
seating plane
0,76(1)
1
2
3
4
5
6
7
8
9
3,9
3,4
0,56
0,4
0,254 Ⓜ
3,5 max
2,54 (9x)
3,5 max
0,4
18 hole spacing
3(2) min
mounting base
A = 3
1
metal tab
Ø3,5 (2x)
0,25
0,15
6,1
11 max
4 max (3)
7Z75319.1

(1) Tolerance applies within this zone.
(2) Distance applies within zone A.
(3) For the OM323A: 3 mm maximum.

Fig. 2 Encapsulation.

Terminal connections

1 = Input
2, 3, 5, 6, 7, 8 = Common, connected to mounting tab
4 = Supply (+)
9 = Output

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

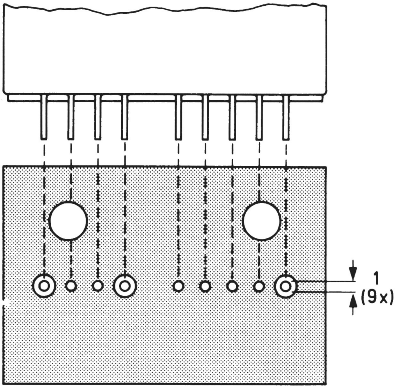
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

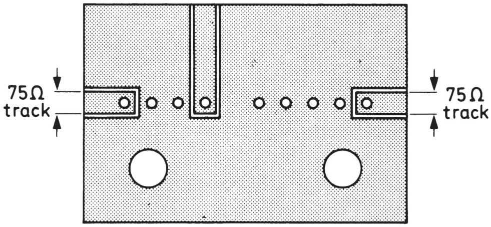
The module should preferably be mounted on a double-sided printed-circuit board, see the following example. An example is also given of heatsink mounting.

Input and output should be connected to 75 Ω tracks.

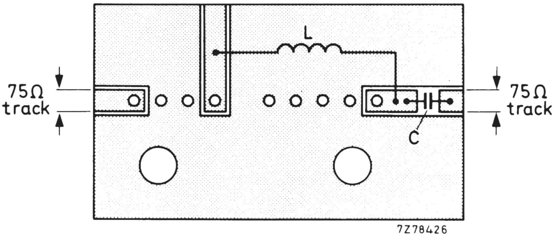
The connections to the common pins should be as close to the seating plane as possible.



top view


75Ω
track
75Ω
track
7Z75320

OM323: bottom view


L
75Ω
track
75Ω
track
C
7Z78426

OM323A: bottom view

Fig. 3 Printed-circuit board holes and tracks for the OM323 and OM323A.

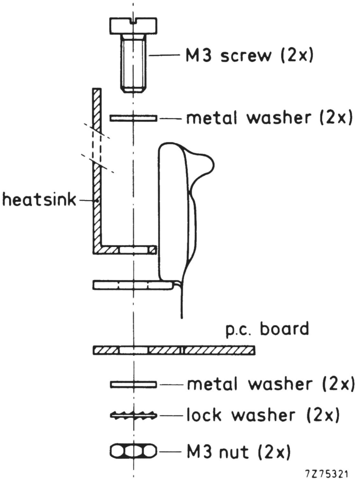

M3 screw (2x)
metal washer (2x)
heatsink
p.c. board
metal washer (2x)
lock washer (2x)
M3 nut (2x)
7Z75321

Fig. 4 Example of heatsink mounting.

L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.

C > 220 pF ceramic capacitor.

HYBRID VHF/UHF WIDE-BAND AMPLIFIER

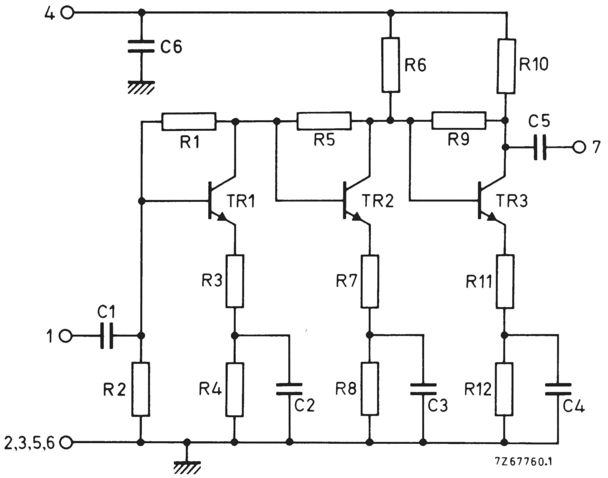
Three-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster-amplifiers, as pre-amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_0$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	27	dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ.	1,6	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone)	$V_{o(rms)}$	>	98	dBμV
Noise figure	F	typ.	5,5	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to + 70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M} $-V_{1M}$, $-V_{7M}$	max. max.	28 10	V V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	35	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	 typ.	23 to 31 27	dB dB
Flatness of frequency response	$\pm\Delta \lvert s_f \rvert^2$	typ.	1,6	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,9	**
output	$VSWR_{(o)}$	typ.	3,2	**
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	46	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	40	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone)	$V_{o(rms)}$	> typ.	98 101	dBμV dBμV
Noise figure	F	typ.	5,5	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

---

* This socket can be made available for customer reference purposes.

** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

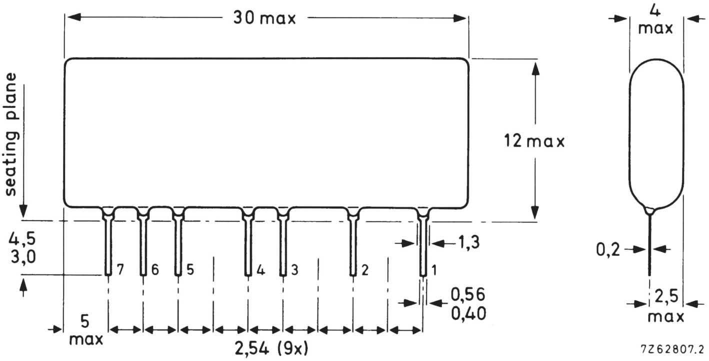
Ambient temperature range	T_{amb}		−20 to + 70	°C
D. C. supply voltage	V_B	=	24	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_S, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated.


30 max
12 max
seating plane
4,5
3,0
7
6
5
4
3
2
1
1,3
0,56
0,40
5
max
2,54 (9x)
4
max
0,2
2,5
max
7Z62807.2

Terminal connections

1 = Input
2, 3, 5, 6 = Common
4 = Supply (+)
7 = Output

Soldering recommendations

Hand soldering

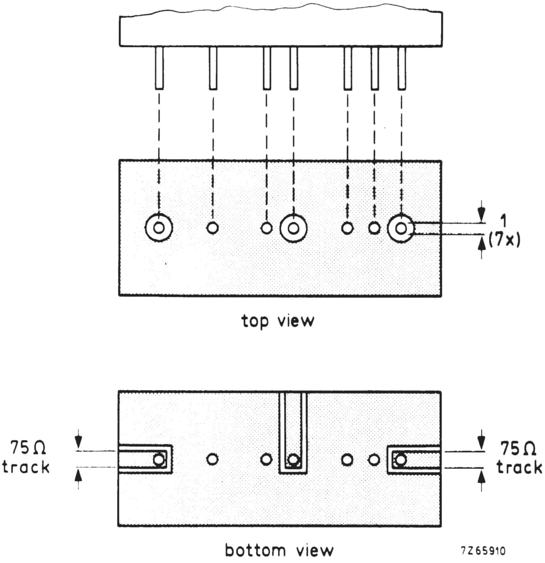
Maximum contact time for a soldering-iron temperature of 260 °C; up to seating plane:	5	s

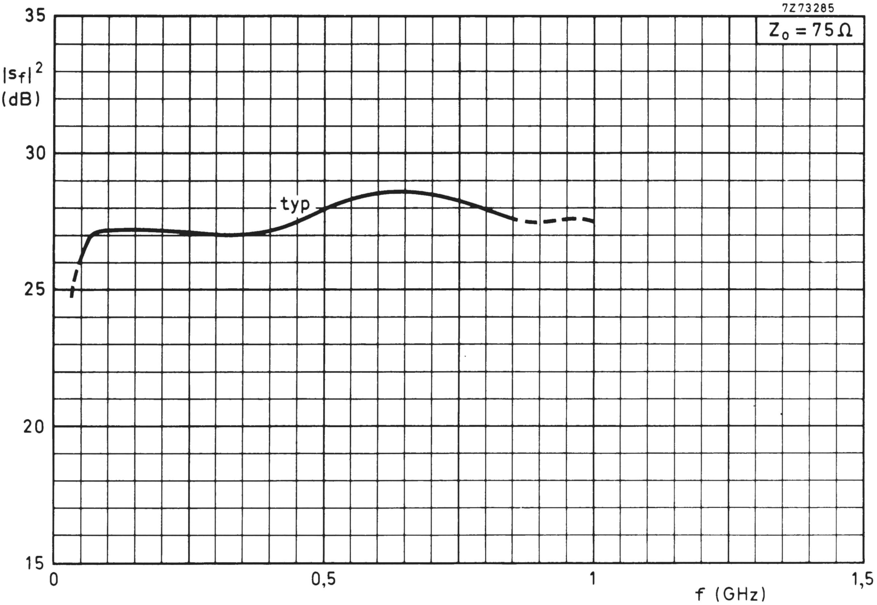
Dip or wave soldering

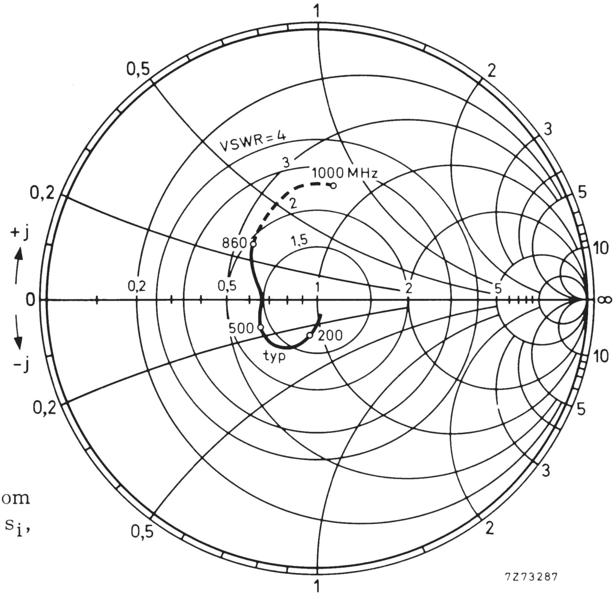
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

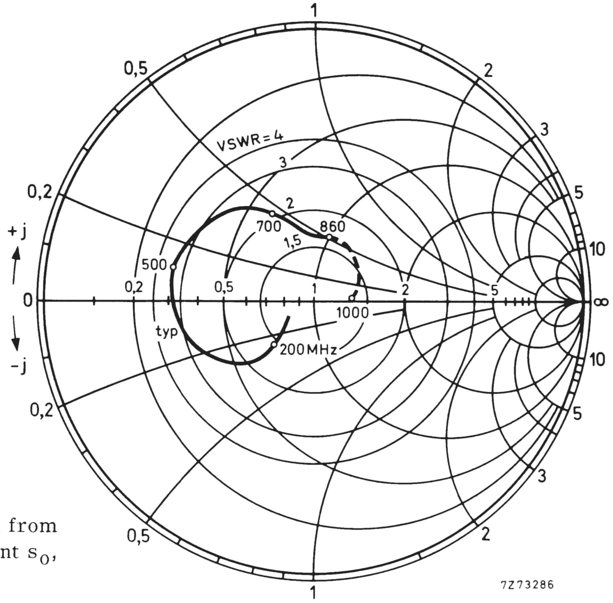
The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.
Input and output should be connected to 75 Ω tracks.
The connections to the "common" pins should be as close to the seating plane as possible.







Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75.



Output impedance derived from output reflection coefficient s_0, co-ordinates in ohm x 75.

HYBRID VHF/UHF WIDE-BAND AMPLIFIER

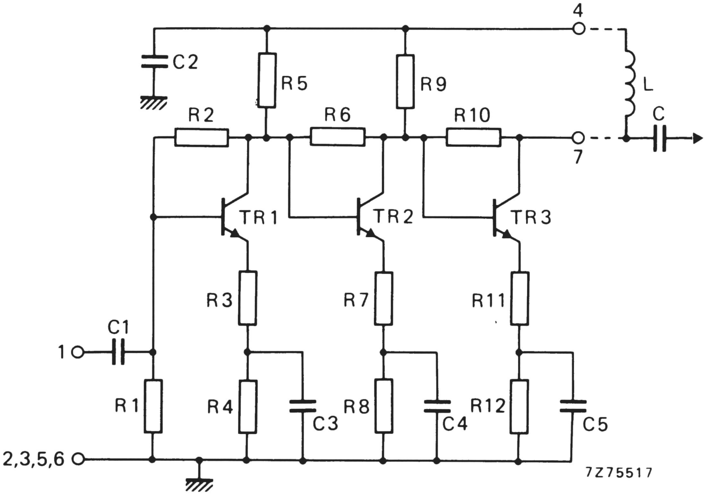
Three-stage wide-band amplifier in the hybrid technique, designed for use in mast-head booster-amplifiers, as preamplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	22	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,0	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA

CIRCUIT DIAGRAM



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}$, $-V_{7M}$	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	65	mA
Transducer gain	$G_{tr} = \|s_f\|^2$		20 to 24	dB
		typ.	22	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,0	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,4	**
output	$VSWR_{(o)}$	typ.	1,6	**
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	42	dB
f = 860 MHz	$\|s_r\|^2$	typ.	40	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	105	dBμV
		typ.	107	dBμV
Noise figure	F	typ.	7	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

---

* This socket can be made available for customer reference purposes.

** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

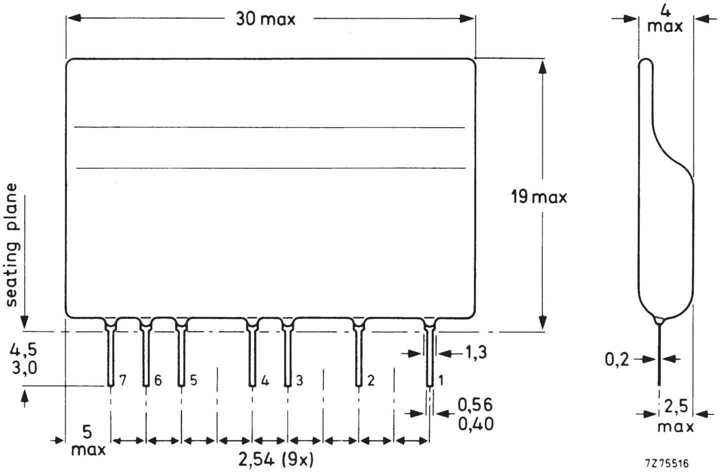
Ambient temperature range	T_{amb}	−20 to +70 °C
D.C. supply voltage	V_B	= 24 V ±10%
Frequency range	f	40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	= 75 Ω

MECHANICAL DATA

Dimensions in mm

Encapsulation

The device is resin coated.



Terminal connections

1 = Input
2, 3, 5, 6 = Common
4 = Supply (+)
7 = Output.

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

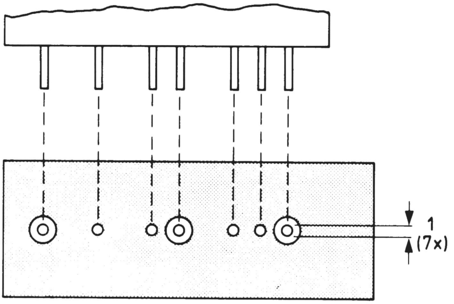
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

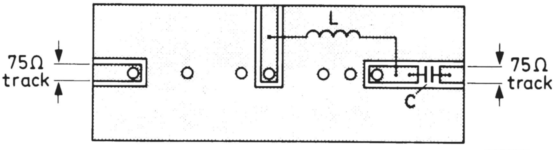
The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



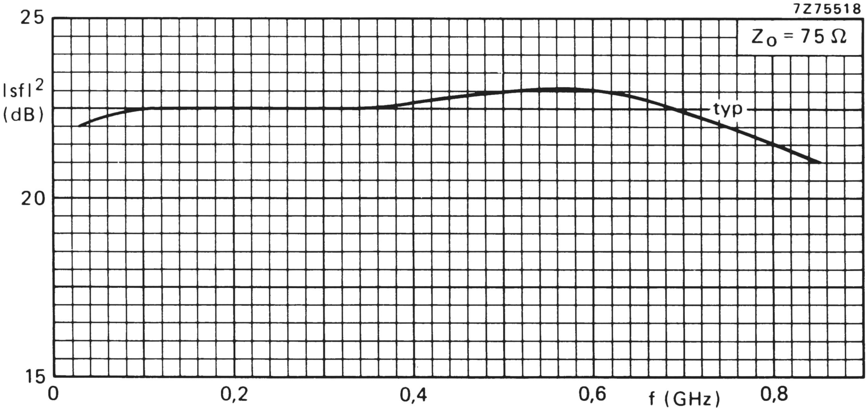
top view



bottom view

L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.

C > 220 pF ceramic capacitor.



HYBRID V.H.F./U.H.F. WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in the hybrid technique, designed for use in MATV systems, and as general purpose amplifier for v.h.f. and u.h.f. applications requiring a high output level.
The OM337A needs an external collector-coil and blocking capacitor, whereas, the OM337 has these components built-in.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	26	dB
Flatness of frequency response	$\pm\Delta \|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN45004, 3-tone); f = 470 MHz	$V_{o(rms)}$	typ.	112	dBμV
Noise figure	F	typ.	9,8	dB
D.C. supply voltage	V_B	=	24	V ± 10%
Operating mounting-base temperature	T_{mb}		−30 to +100	°C

ENCAPSULATION 9-pin, in-line, resin-coated body on a right-angled metal mounting tab, see MECHANICAL DATA

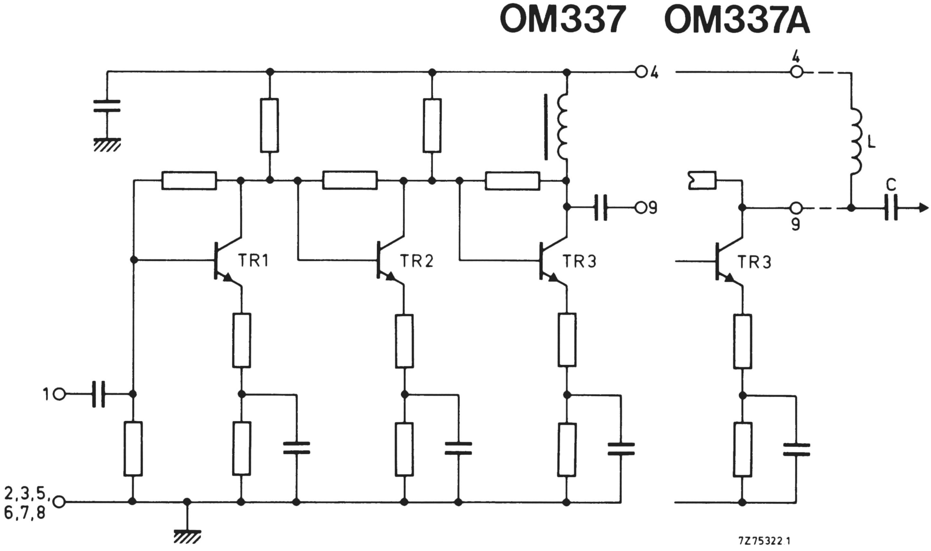


Fig. 1 Circuit diagram.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Operating mounting-base temperature	T_{mb}		−30 to +100	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pin 1	V_{1M} $-V_{1M}$	max. max.	28 24	V V
Peak voltages on pin 9	V_{9M} $-V_{9M}$	max. max.	28 4	V V
Peak incident powers on pins 1 and 9	P_{I1M}, P_{I9M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.—U.H.F. test socket	catalogue no.		3504 110 01830*	
Mounting base temperature	T_{mb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	 typ.	110 to 120 115	mA mA	
Transducer gain	$G_{tr} = \|s_f\|^2$	 typ.	23 to 29 26	dB dB	
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB	
Individual maximum v.s.w.r.					
input	$VSWR_{(i)}$	typ.	2,3		**
output	$VSWR_{(o)}$	typ.	1,8		**
Back attenuation					
f = 100 MHz	$\|s_r\|^2$	typ.	44	dB	
f = 650 MHz	$\|s_r\|^2$	typ.	41	dB	
f = 860 MHz	$\|s_r\|^2$	typ.	43	dB	

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* This socket can be made available for customer reference purposes.
** Highest value, for a sample, occurring in the frequency range.

Output voltage at −60 dB intermodulation distortion (DIN45004, par. 6.3: 3-tone) f = 40–230 MHz	$V_{o(rms)}$	> typ.	113 dBμV 114 dBμV
f = 470 MHz	$V_{o(rms)}$	typ.	112 dBμV
f = 860 MHz	$V_{o(rms)}$	typ.	110 dBμV
Noise figure channel 2	F	typ.	7 dB
channel 65	F	typ.	9,8 dB

s-parameters: $s_f = s_{21}$ $s_i = s_{11}$
$s_r = s_{12}$ $s_o = s_{22}$

OPERATING CONDITIONS

Mounting-base temperature range	T_{mb}		−30 to +100 °C
D.C. supply voltage	V_B	=	24 V ± 10%
Frequency range	f		40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	=	75 Ω

THERMAL DATA

a. The maximum permissible temperature at the mounting base is 100 °C.

b. When the mounting tab is screwed to a double-sided printed-circuit board with dimensions 37 mm x 51 mm, its temperature will be 57 °C above the temperature of the surrounding free air.

c. When a heatsink is fixed to the mounting tab and the pins are soldered into a double-sided printed-circuit board with dimensions 37 mm x 51 mm, the tab will reach the temperatures stated in the following table.

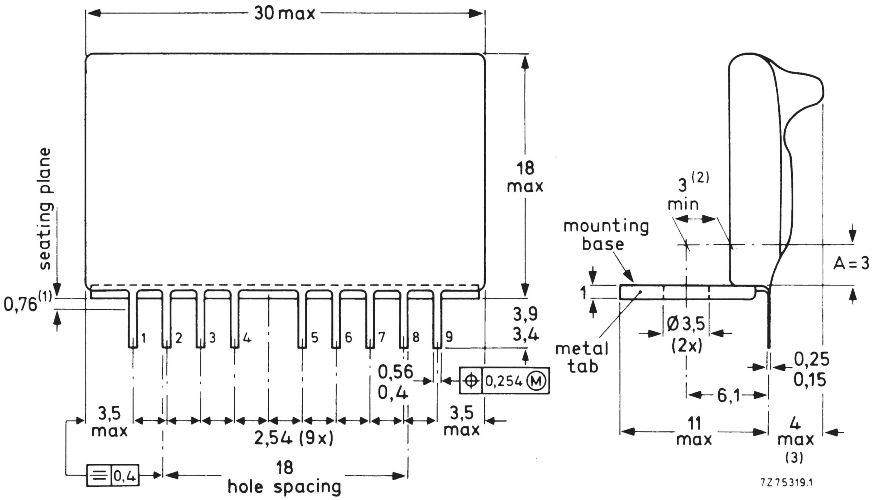
Notes:
1. When the device is fixed only to a heatsink, not to a printed-circuit board, the values of the second column of the table should be increased by 2 °C and those of the third column decreased by 2 °C.
2. The user is free to realize proper cooling by using differently shaped sinks, or, preferably, by fixing the tab to any convenient part of the equipment (e.g. a wall of the metal cabinet).

heatsink data thickness 1 mm	$T_{mb} - T_{amb}$ °C	$T_{amb\,max}$ °C
Bright aluminium heatsink L-shaped bar; length 100 mm, height 65 mm	27,5	72,5
Blackened aluminium heatsink L-shaped bar; length 50 mm, height 70 mm	26,5	73,5

MECHANICAL DATA

Dimensions in mm

The amplifier is resin coated and has a metal mounting tab at a right angle to the encapsulated part.


30 max
18
max
seating plane
0,76(1)
1
2
3
4
5
6
7
8
9
3,9
3,4
0,56
0,4
0,254 (M)
3,5
max
2,54 (9x)
3,5
max
0,4
18
hole spacing
3(2)
min
mounting
base
A = 3
1
metal
tab
Ø3,5
(2x)
0,25
0,15
6,1
11
max
4
max
(3)
7Z75319.1

(1) Tolerance applies within this zone.
(2) Distance applies within zone A.
(3) For the OM337A: 3 mm maximum.

Fig. 2 Encapsulation.

Terminal connections

1 = Input
2, 3, 5, 6, 7, 8 = Common, connected to mounting tab
4 = Supply (+)
9 = Output

Soldering recommendations

Hand soldering

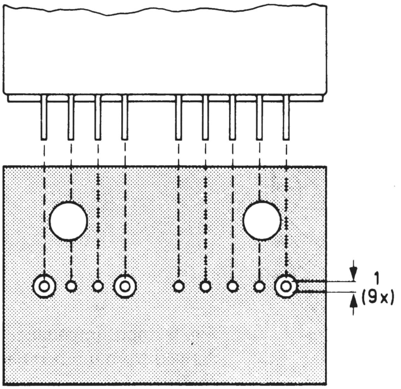
Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

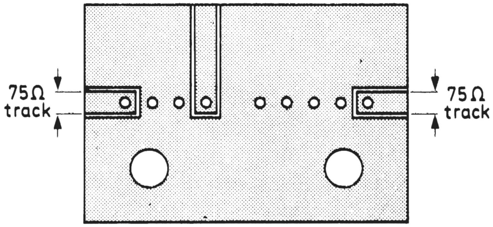
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

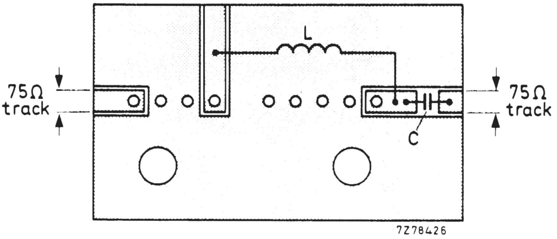
The module should preferably be mounted on a double-sided printed-circuit board, see the following example. An example is also given of heatsink mounting.
Input and output should be connected to 75 Ω tracks.
The connections to the common pins should be as close to the seating plane as possible.



top view


75Ω
track
75Ω
track
7Z75320

OM337: bottom view.


L
75Ω
track
75Ω
track
C
7Z78426

OM337A: bottom view.

Fig. 3 Printed-circuit board holes and tracks for the OM337 and OM337A.

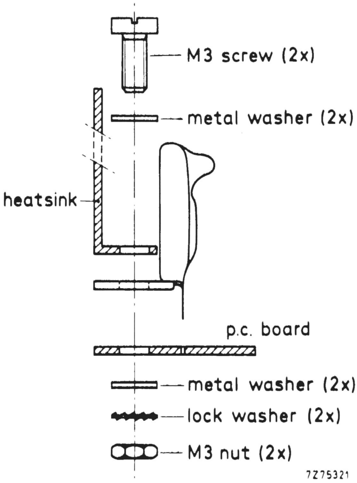

M3 screw (2x)
metal washer (2x)
heatsink
p.c. board
metal washer (2x)
lock washer (2x)
M3 nut (2x)
7Z75321

Fig. 4 Example of heatsink mounting.

L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

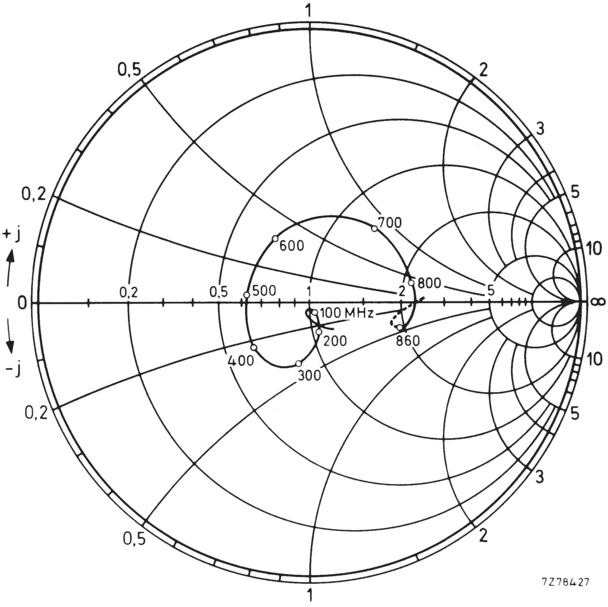


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

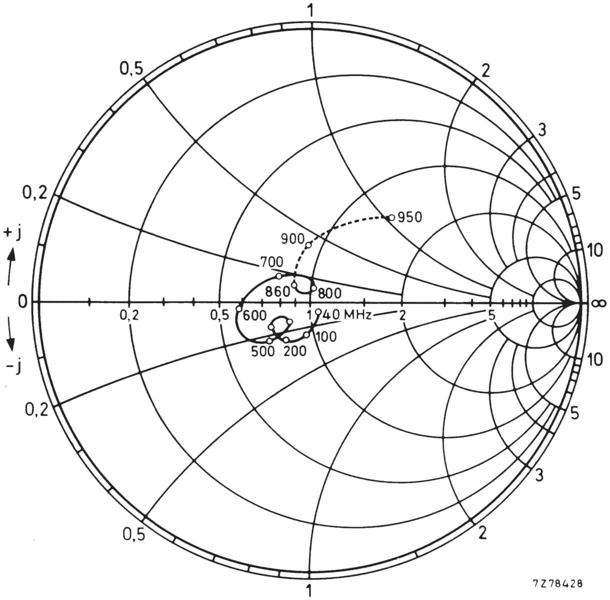


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

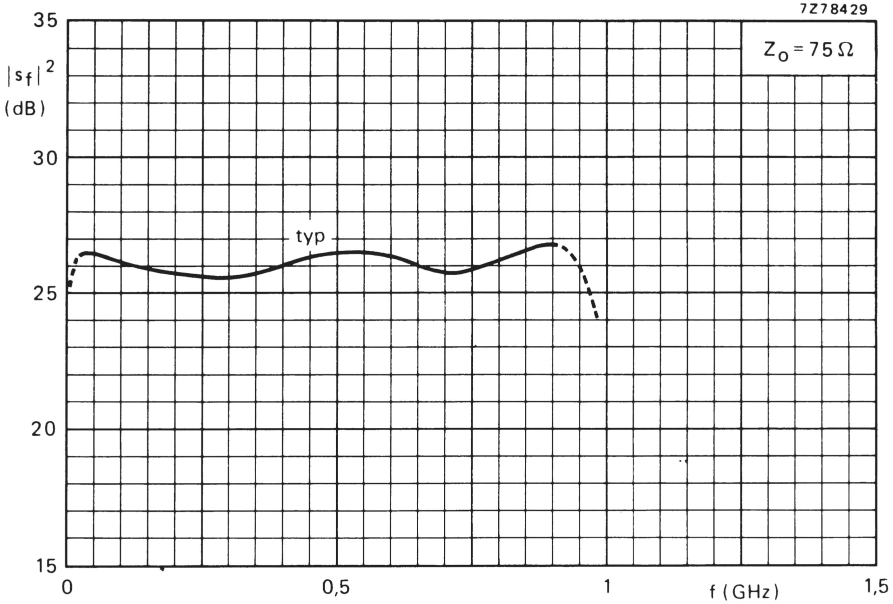


Fig. 7 Transducer gain as a function of frequency.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in the hybrid integrated circuit technique, designed for use in mast-head booster-amplifiers, as amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_S = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	28	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,5	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	6	dB
D.C. supply voltage	V_B	=	24	V ±10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 7-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

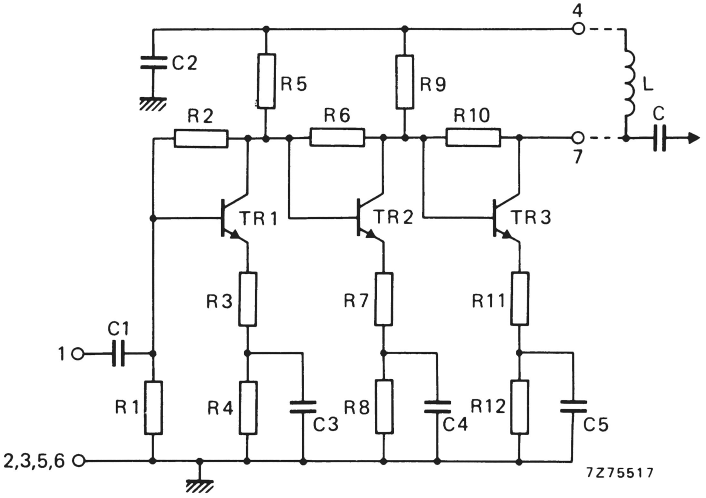


Fig. 1 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	28	V
Peak voltages on pins 1 and 7	V_{1M}, V_{7M}	max.	28	V
	$-V_{1M}, -V_{7M}$	max.	10	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

V.H.F.-U.H.F. test socket	catalogue no. 3504 110 01840 *			
Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	24	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	67	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$		25 to 30	dB
		typ.	28	dB
Flatness of frequency response	$\pm\Delta\lvert s_f \rvert^2$	typ.	1,5	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,5	**
output	$VSWR_{(o)}$	typ.	1,5	**
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	46	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	31	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	105	dBμV
		typ.	107	dBμV
Noise figure	F	typ.	6	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

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* This socket can be made available for customer reference purposes.

** Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}	−20 to +70 °C
D.C. supply voltage	V_B	= 24 V ±10%
Frequency range	f	40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	= 75 Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

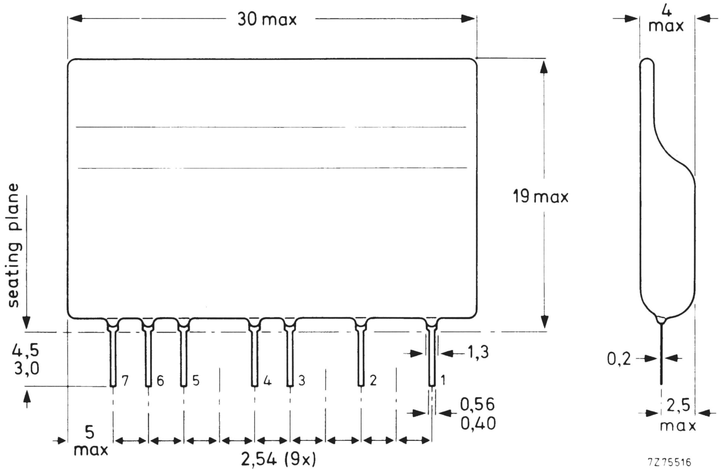


Fig. 2 Encapsulation.

Terminal connections

1 = input
2, 3, 5, 6 = common
4 = supply (+)
7 = output

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

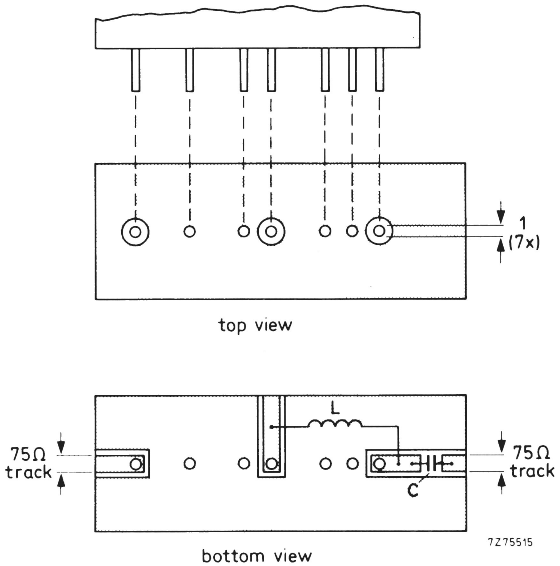
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

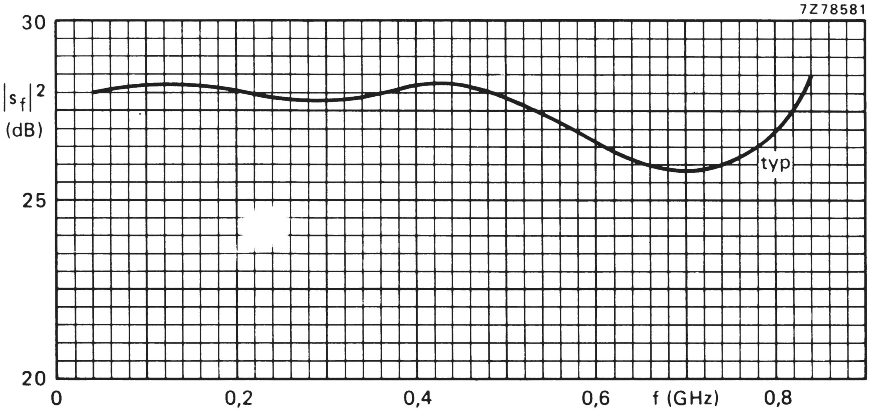


Fig. 4 Transducer gain as a function of frequency; $Z_o = 75\ \Omega$.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

One-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for aerial amplifiers in car radios, caravans or RATV and MATV applications.

QUICK REFERENCE DATA

D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	12	dB
Flatness of frequency response	$\pm \Delta \|s_f\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	typ.	99	dBμV
Noise figure	F	typ.	5,5	dB
Operating ambient temperature	T_{amb}		−20 to + 70	°C

ENCAPSULATION 5-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

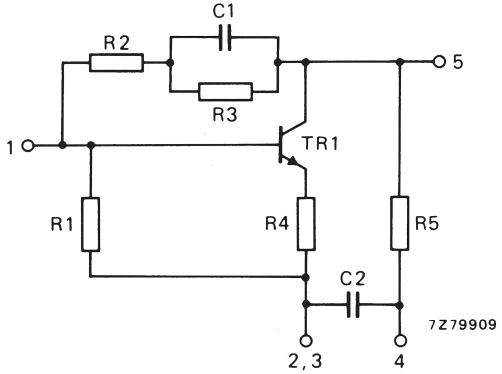


Fig. 1 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}		–20 to +70	°C
Storage temperature	T_{stg}		–40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 5	P_{I1M}, P_{I5M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	11,5	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	12	dB
Flatness of frequency response	$\pm \Delta \lvert s_f \rvert^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,0	*
output	$VSWR_{(o)}$	typ.	1,4	*
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	22	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	19	dB
Output voltage at –60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	typ.	99	dBμV
Noise figure	F	typ.	5,5	dB

s-parameters: $s_f = s_{21}$ $s_i = s_{11}$
$s_r = s_{12}$ $s_o = s_{22}$

---

* Highest value, for a sample, occuring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to + 70	°C
D.C. supply voltage	V_B	=	12	V ±10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

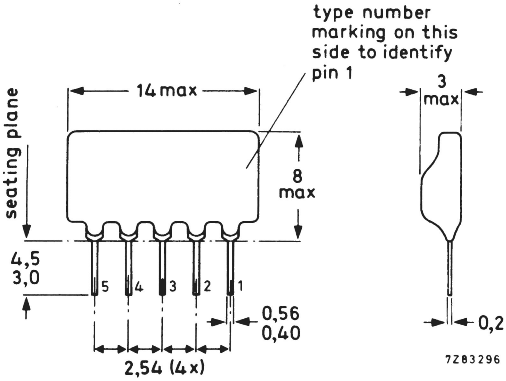

type number marking on this side to identify pin 1
14 max
3 max
seating plane
8 max
4,5
3,0
5
4
3
2
1
0,56
0,40
0,2
2,54 (4 x)
7Z83296

Fig. 2 Encapsulation.

Terminal connections

1 = input
2,3 = common
4 = supply (+)
5 = output

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.

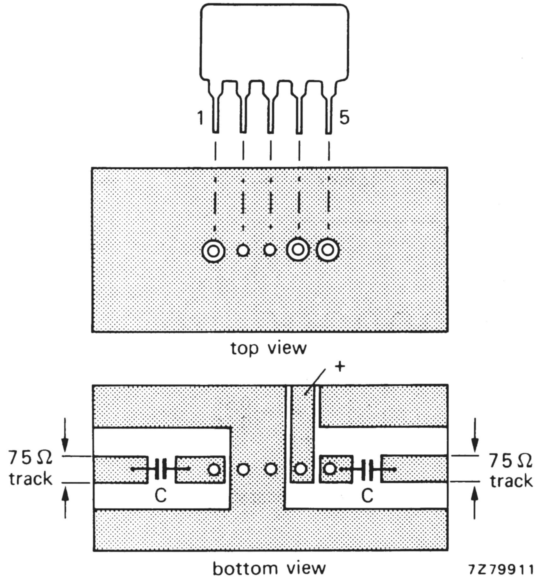

1
5
top view
+
75 Ω
track
C
C
75 Ω
track
bottom view
7Z79911

Fig. 3 Printed-circuit board holes and tracks.
C > 220 pF ceramic capacitor.

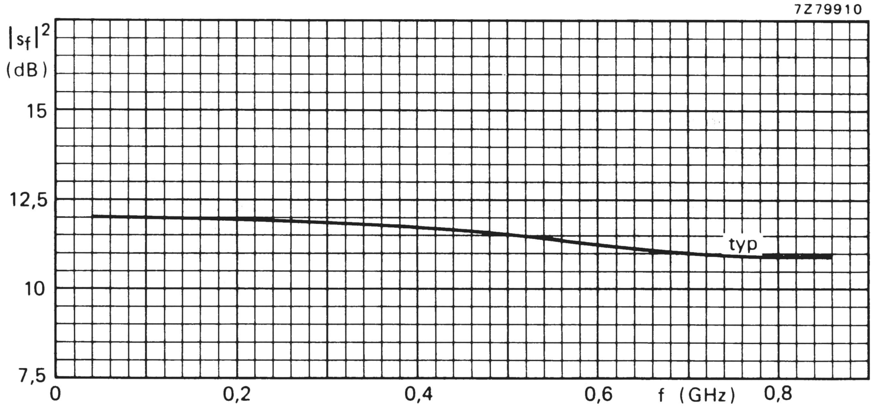


Fig. 4 Transducer gain as a function of frequency; $Z_o = 75\ \Omega$.

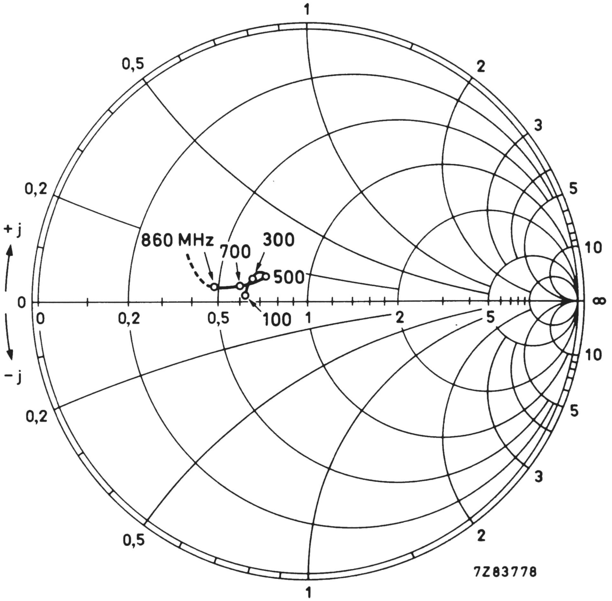


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

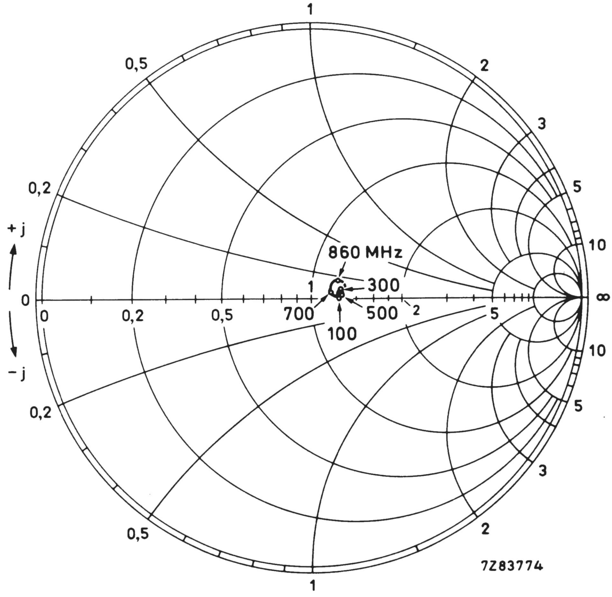


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

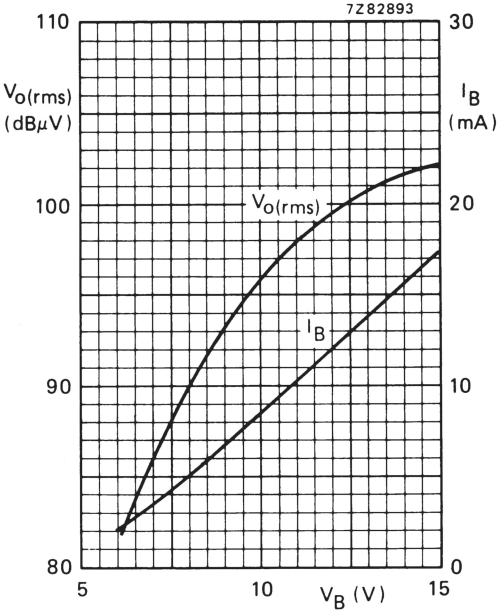


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

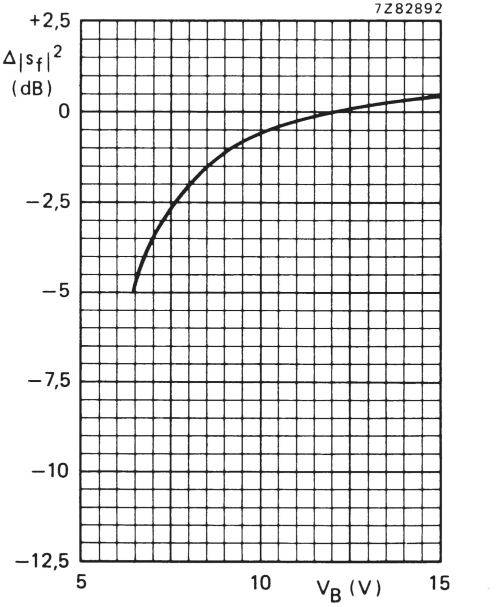


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V; f = 100 to 860 MHz; typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Two-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for RATV and MATV applications.

QUICK REFERENCE DATA

D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	18	dB
Flatness of frequency response	$\pm \Delta \lvert s_f \rvert^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	typ.	100	dBμV
Noise figure	F	typ.	6	dB
Operating ambient temperature	T_{amb}	−20 to	+ 70	°C

ENCAPSULATION 5-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

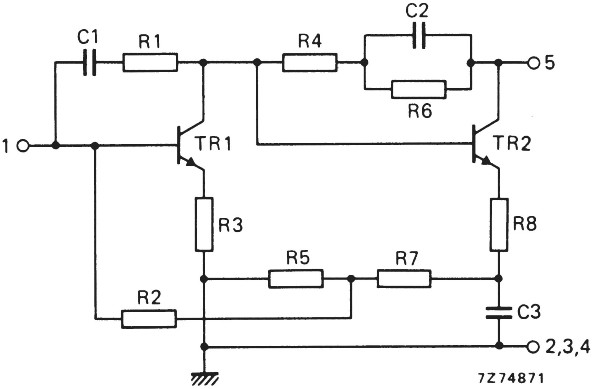


Fig. 1 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}	–20 to	+ 70	°C
Storage temperature	T_{stg}	–40 to	+ 125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 5	P_{I1M}, P_{I5M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	18	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	18	dB
Flatness of frequency response	$\pm \Delta \|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,5	*
output	$VSWR_{(o)}$	typ.	1,9	*
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	29	dB
f = 860 MHz	$\|s_r\|^2$	typ.	25	dB
Output voltage at –60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	typ.	100	dBμV
Noise figure	F	typ.	6	dB

s-parameters: $s_f = s_{21}$ $s_i = s_{11}$

$s_r = s_{12}$ $s_o = s_{22}$

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* Highest value, for a sample, occuring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to + 70	°C
D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

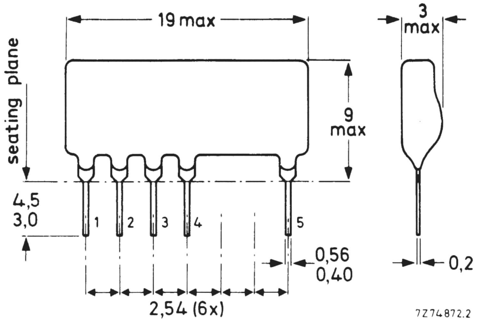


Fig. 2 Encapsulation.

Terminal connections

1 = input
2,3,4 = common
5 = output/supply(+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

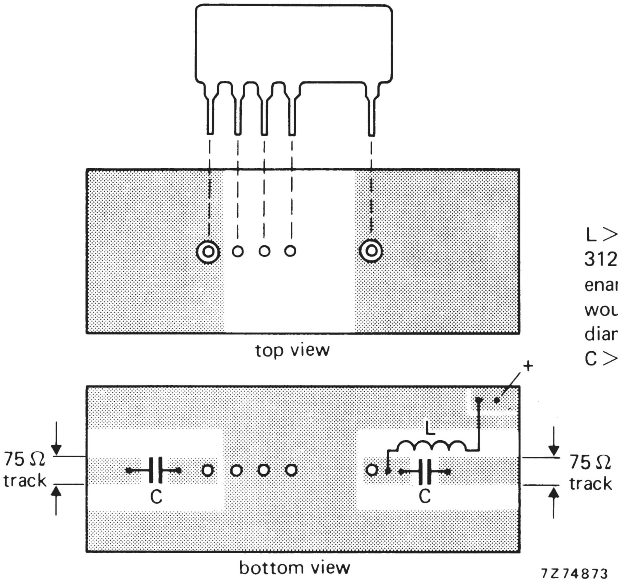
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



$L > 5\ \mu H$; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
$C > 220$ pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

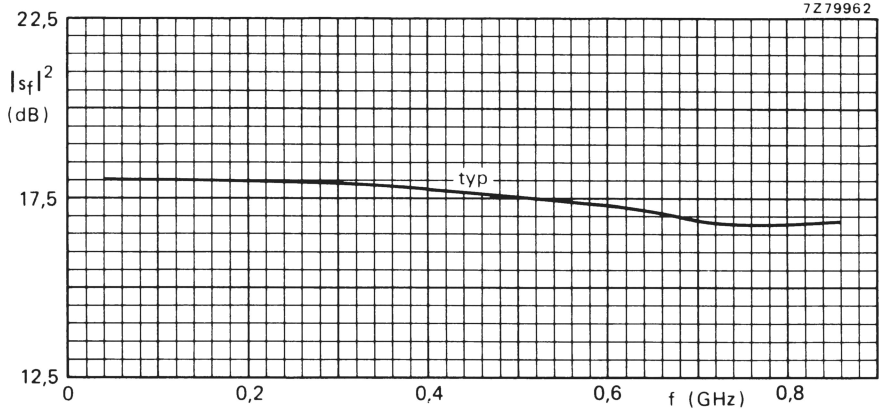


Fig. 4 Transducer gain as a function of frequency; $Z_o = 75\ \Omega$.

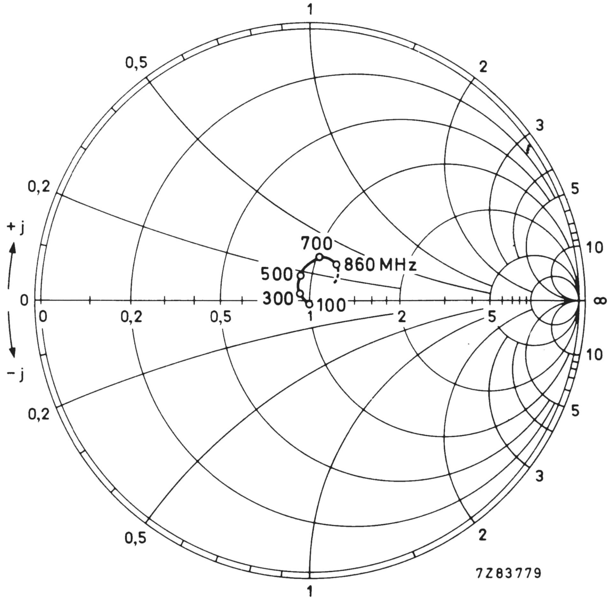


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

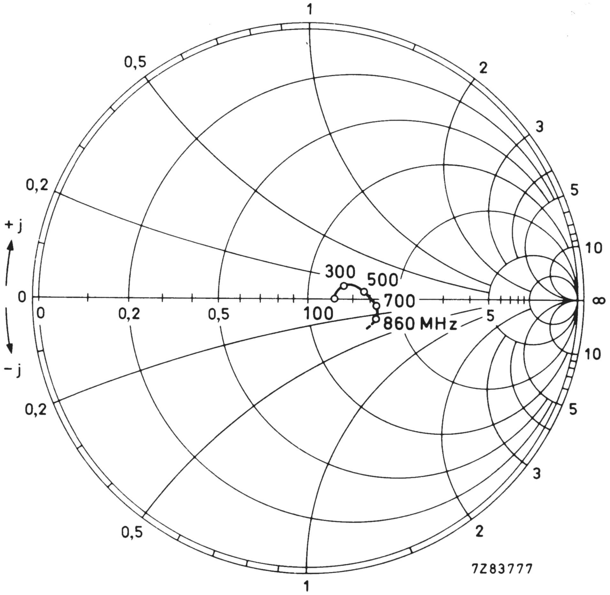


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

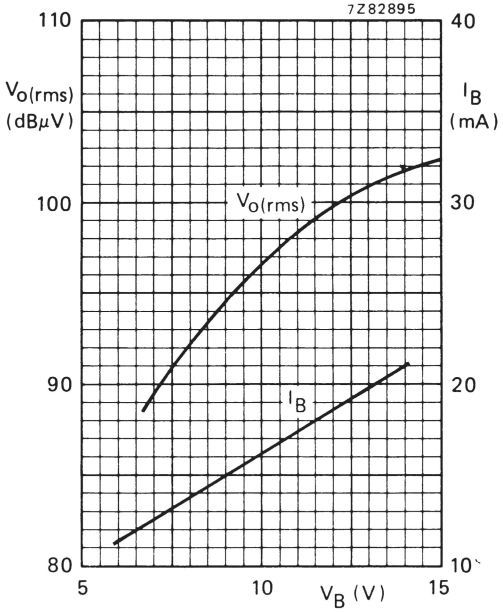


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

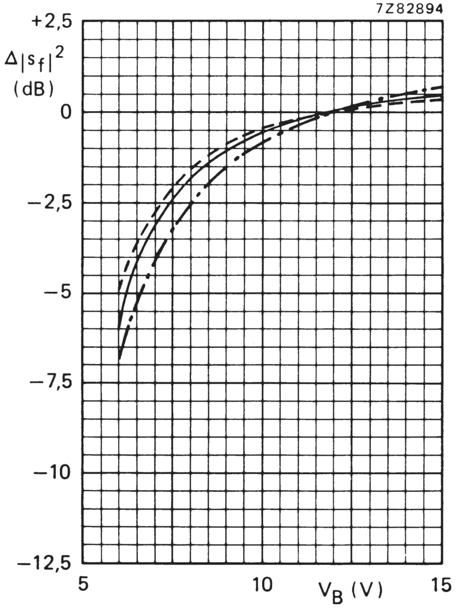


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V:
——— f = 500 MHz;
– – – – f = 100 MHz;
—·—·—· f = 860 MHz;
typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for use in mast-head booster-amplifiers, as preamplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	23	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	0,5	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	12	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 8-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

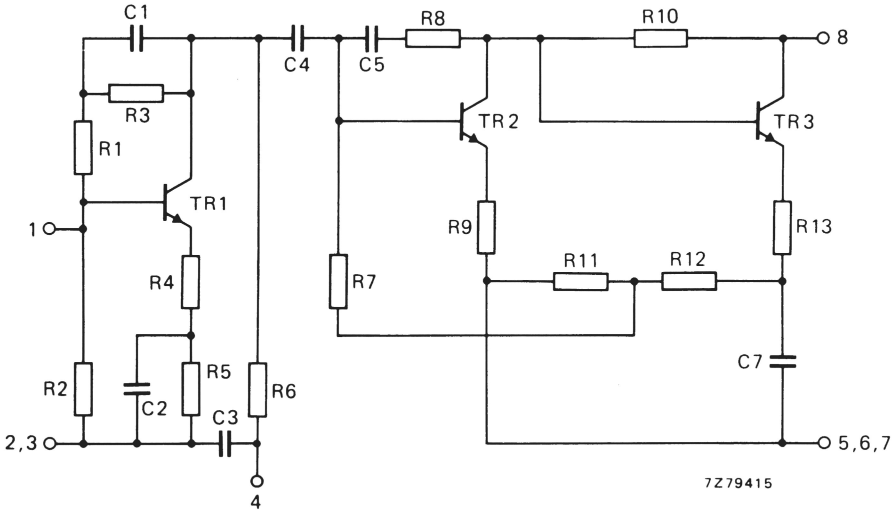


Fig. 1 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	55	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	23	dB
			21 to 25	dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	0,5	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,3	*
output	$VSWR_{(o)}$	typ.	1,5	*
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	42	dB
f = 860 MHz	$\|s_r\|^2$	typ.	33	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	>	105	dBμV
		typ.	107	dBμV
Noise figure	F	typ.	7	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

---

* Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}	−20 to +70 °C
D.C. supply voltage	V_B	= 12 V ± 10%
Frequency range	f	40 to 860 MHz
Source impedance and load impedance	R_s, R_ℓ	= 75 Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

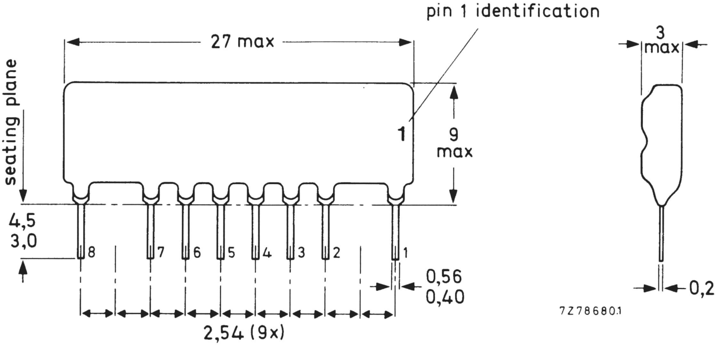


Fig. 2 Encapsulation.

Terminal connections

1 = input
2, 3, 5, 6, 7 = common
4 = supply (+)
8 = output/supply (+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

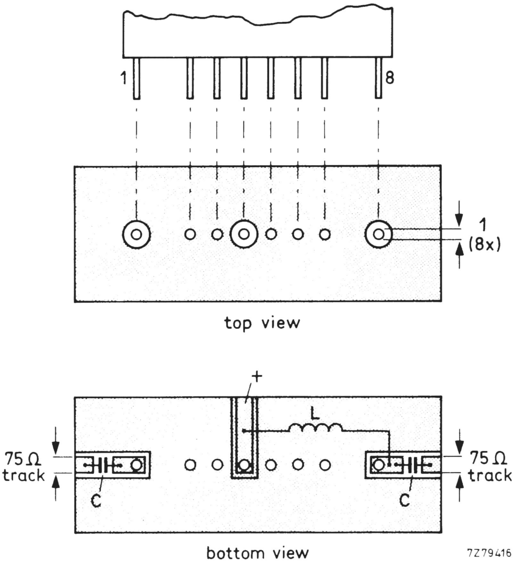
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

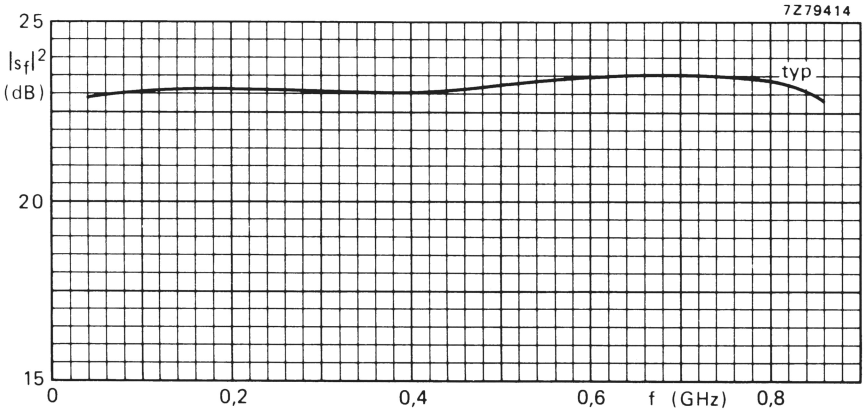


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

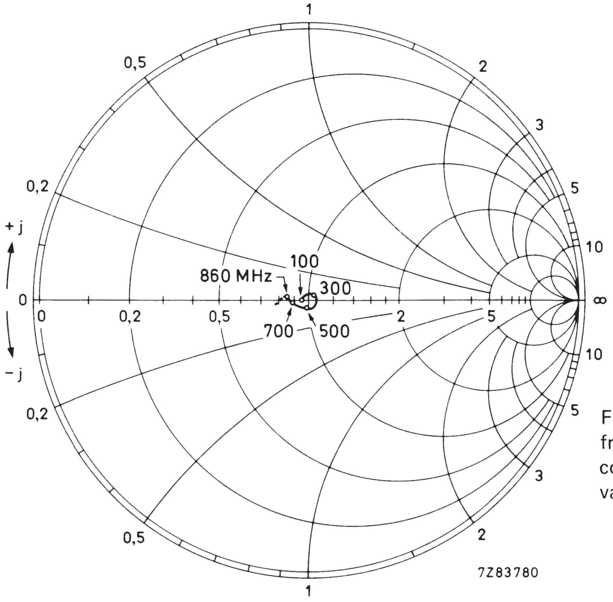


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

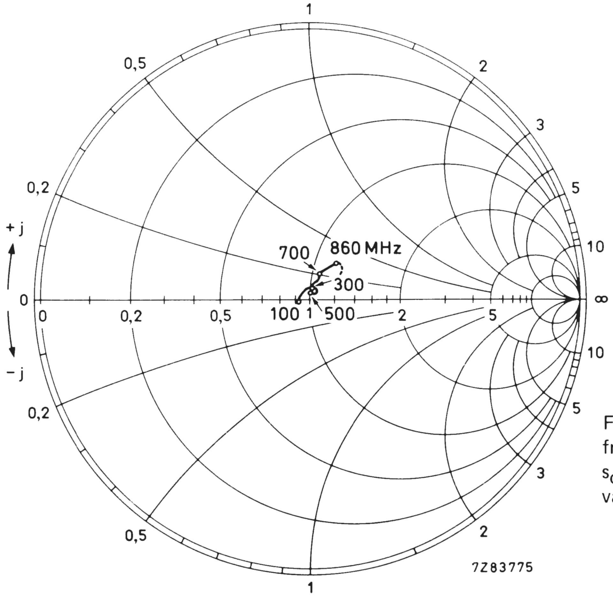


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

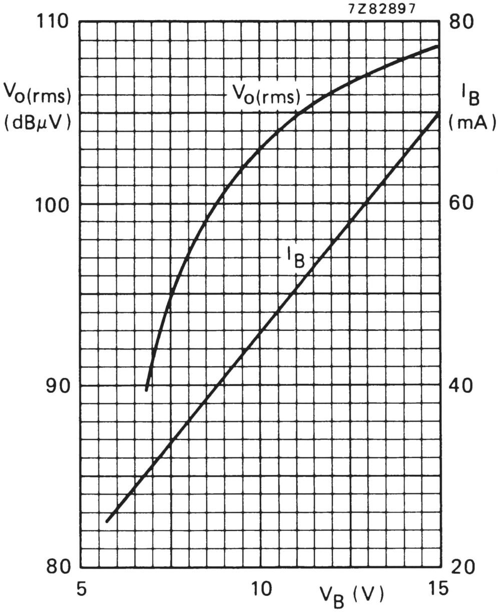


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

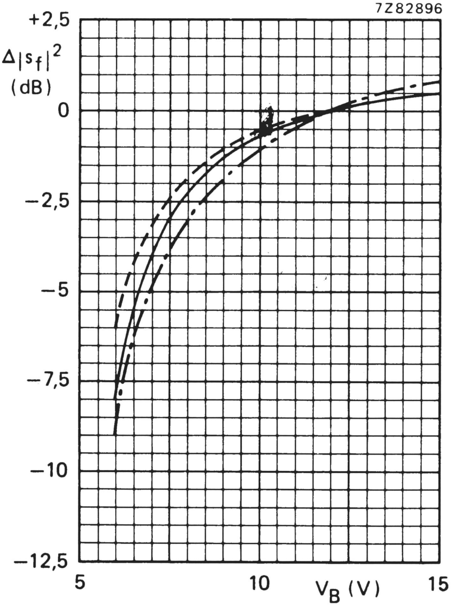


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V;
——— f = 500 MHz;
– – – – f = 100 MHz;
—·—·— f = 860 MHz;
typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for use in mast-head booster-amplifiers, as an amplifier in MATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	28	dB
Flatness of frequency response	$\pm\Delta\lvert s_f \rvert^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)	$V_{o(rms)}$	>	105	dBμV
Noise figure	F	typ.	6	dB
D.C. supply voltage	V_B	=	12	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 8-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig. 2)

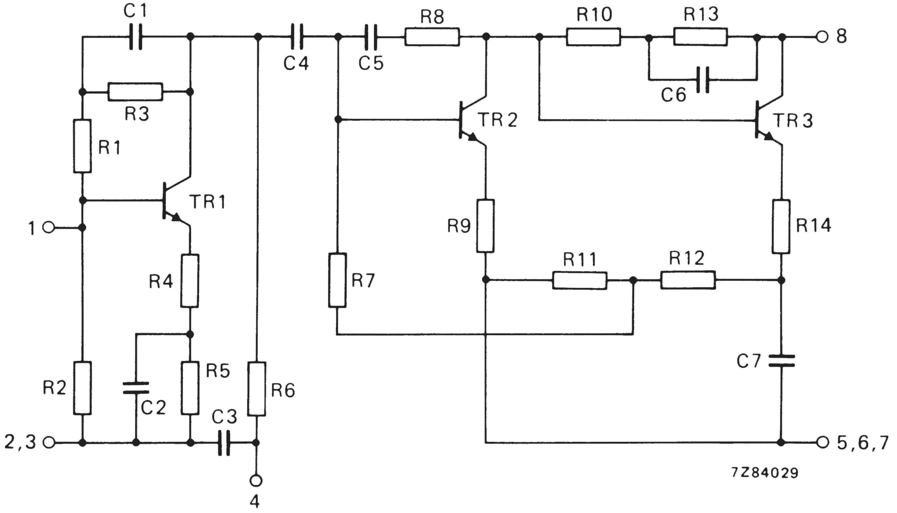


Fig. 1 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 8	P_{I1M}, P_{I8M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	50	mA
Transducer gain	$G_{tr} = \|s_f\|^2$	typ.	28 26 to 31	dB dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	1,5	*
output	$VSWR_{(o)}$	typ.	1,7	*
Back attenuation				
f = 100 MHz	$\|s_r\|^2$	typ.	45	dB
f = 860 MHz	$\|s_r\|^2$	typ.	35	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6,3; 3-tone)	$V_{o(rms)}$	> typ.	105 107	dBμV dBμV
Noise figure	F	typ.	6	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

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* Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

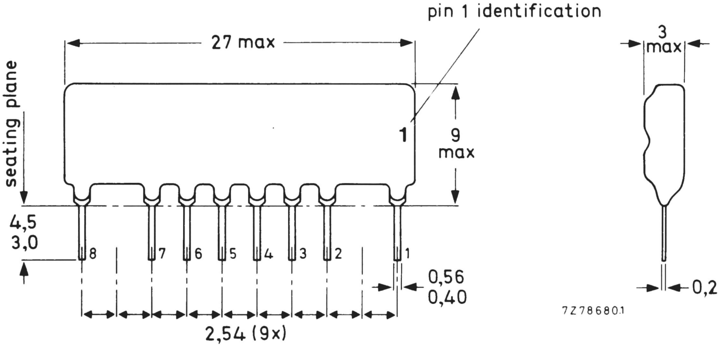


Fig. 2 Encapsulation.

Terminal connections

1 = input
2, 3, 5, 6, 7 = common
4 = supply (+)
8 = output/supply (+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

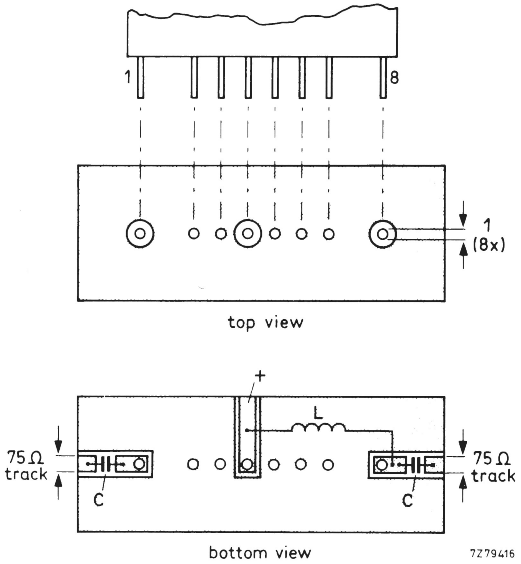
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core (material 4B1; catalogue number 3122 104 91110) with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

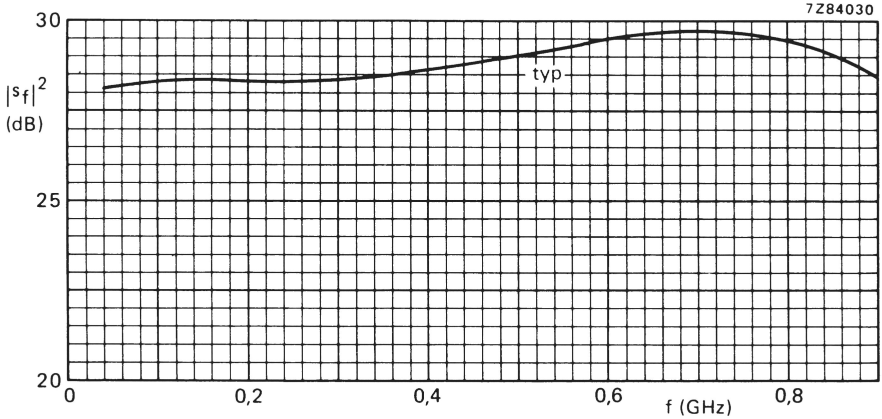


Fig. 4 Transducer gain as a function of frequency; $Z_O = 75\ \Omega$.

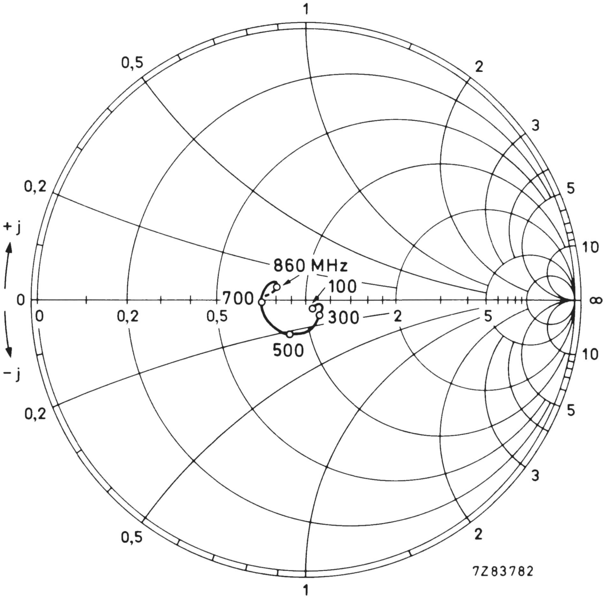


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

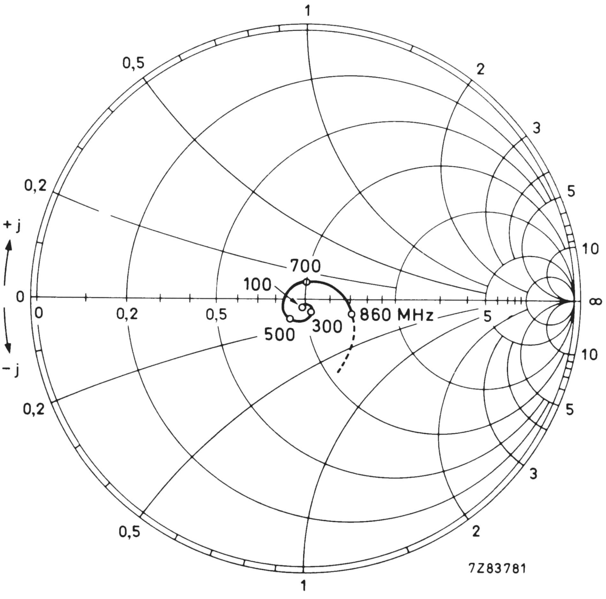


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

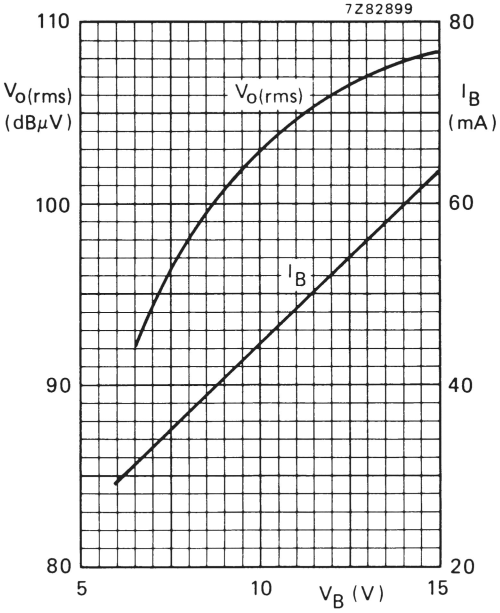


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

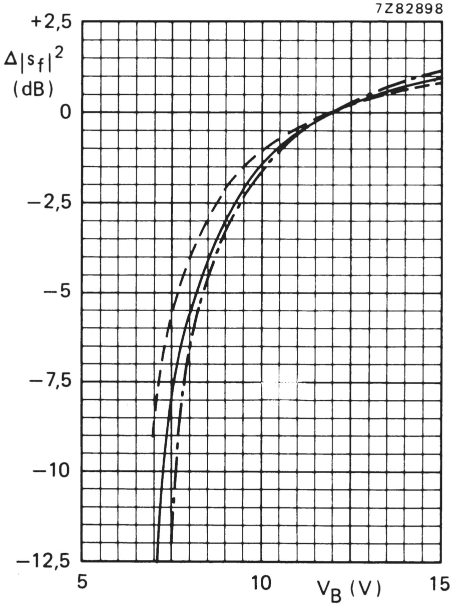


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V;
——— f = 500 MHz;
– – – – f = 100 MHz;
—·—·—· f = 860 MHz;
typical values.

HYBRID INTEGRATED CIRCUIT VHF/UHF WIDE-BAND AMPLIFIER

Three-stage wide-band amplifier in hybrid integrated circuit technique on a thin-film substrate, intended for use in mast-head booster-amplifiers, as an amplifier in MATV and CATV systems, and as general-purpose amplifier for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA

Frequency range	f		40 to 860	MHz
Source and load (characteristic) impedance	$R_s = R_\ell = Z_o$	=	75	Ω
Transducer gain	$G_{tr} = \|s_{fl}\|^2$	typ.	28	dB
Flatness of frequency response	$\pm\Delta\|s_{fl}\|^2$	typ.	1	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, 3-tone)				
VHF	$V_{o(rms)}$	typ.	113	dBμV
UHF	$V_{o(rms)}$	typ.	112	dBμV
Noise figure	F	typ.	7	dB
D.C. supply voltage	V_B	=	12	V ± 10%
Operating ambient temperature	T_{amb}		−20 to +70	°C

ENCAPSULATION 9-pin, in-line, resin-coated body, see MECHANICAL DATA (Fig.2)

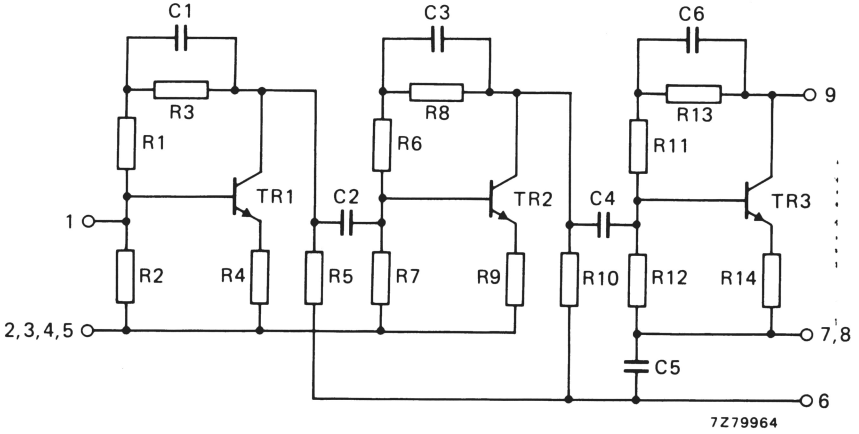


Fig. 1 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}		−20 to +70	°C
Storage temperature	T_{stg}		−40 to +125	°C
D.C. supply voltage	V_B	max.	15	V
Peak incident powers on pins 1 and 8	P_{I1M}, P_{I8M}	max.	100	mW

CHARACTERISTICS

Measuring conditions

Ambient temperature	T_{amb}	=	25	°C
D.C. supply voltage	V_B	=	12	V
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω
Characteristic impedance of h.f. connections	Z_o	=	75	Ω
Frequency range	f	=	40 to 860	MHz

Performance

Supply current	I_B	typ.	105	mA
Transducer gain	$G_{tr} = \lvert s_f \rvert^2$	typ.	28	dB
			26 to 31	dB
Flatness of frequency response	$\pm\Delta\lvert s_f \rvert^2$	typ.	1	dB
Individual maximum v.s.w.r.				
input	$VSWR_{(i)}$	typ.	2,3	*
output	$VSWR_{(o)}$	typ.	1,9	*
Back attenuation				
f = 100 MHz	$\lvert s_r \rvert^2$	typ.	45	dB
f = 860 MHz	$\lvert s_r \rvert^2$	typ.	35	dB
Output voltage at −60 dB intermodulation distortion (DIN 45004, par. 6,3; 3-tone)				
VHF	$V_{o(rms)}$	>	111	dBμV
		typ.	113	dBμV
UHF	$V_{o(rms)}$	>	110	dBμV
		typ.	112	dBμV
Noise figure	F	typ.	7	dB

s-parameters:	$s_f = s_{21}$	$s_i = s_{11}$
	$s_r = s_{12}$	$s_o = s_{22}$

---

* Highest value, for a sample, occurring in the frequency range.

OPERATING CONDITIONS

Ambient temperature range	T_{amb}		−20 to +70	°C
D.C. supply voltage	V_B	=	12	V ± 10%
Frequency range	f		40 to 860	MHz
Source impedance and load impedance	R_s, R_ℓ	=	75	Ω

MECHANICAL DATA

Dimensions in mm

The device is resin coated.

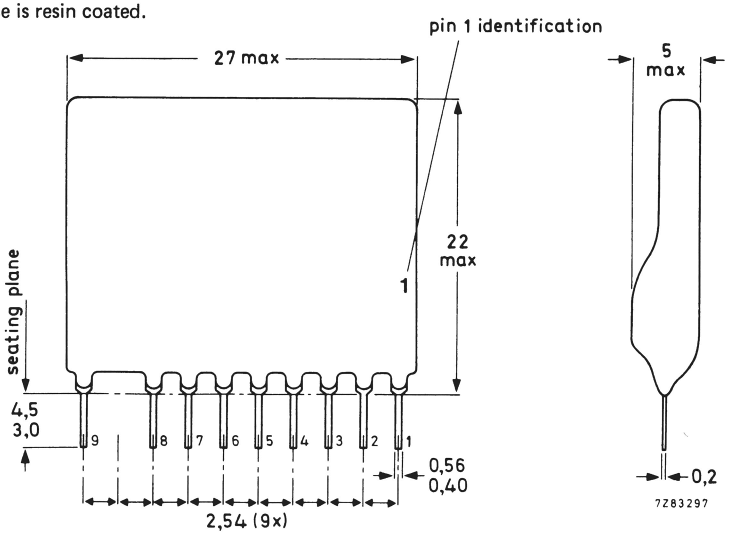


Fig. 2 Encapsulation.

Terminal connections

1 = input
2, 3, 4, 5 and 7, 8 = common
6 = supply (+)
9 = output/supply (+)

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260 °C up to the seating plane is 5 s.

Dip or wave soldering

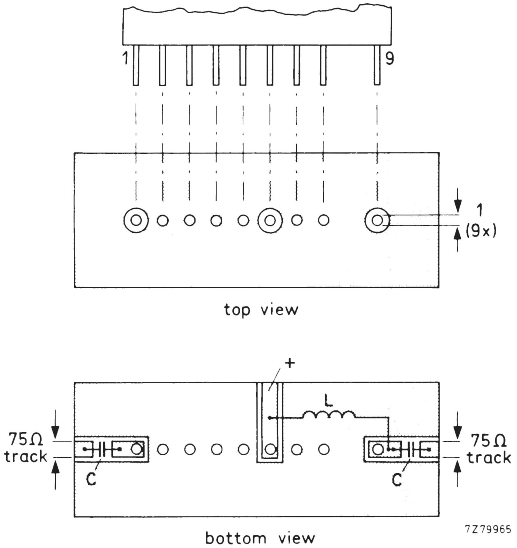
260 °C is the maximum permissible temperature of the solder; it must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds. The device may be mounted against the printed-circuit board, but the temperature of the device must not exceed 125 °C. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature below the allowable limit.

Mounting recommendations

The module should preferably be mounted on double-sided printed-circuit board, see the example shown below.

Input and output should be connected to 75 Ω tracks.

The connections to the 'common' pins should be as close to the seating plane as possible.



L > 5 μH; e.g. catalogue no. 3122 108 20150 or 27 turns enamelled Cu wire (0,3 mm) wound on a ferrite core (material 4B1; catalogue no. 3122 104 91110) with a diameter of 1,6 mm.
C > 220 pF ceramic capacitor.

Fig. 3 Printed-circuit board holes and tracks.

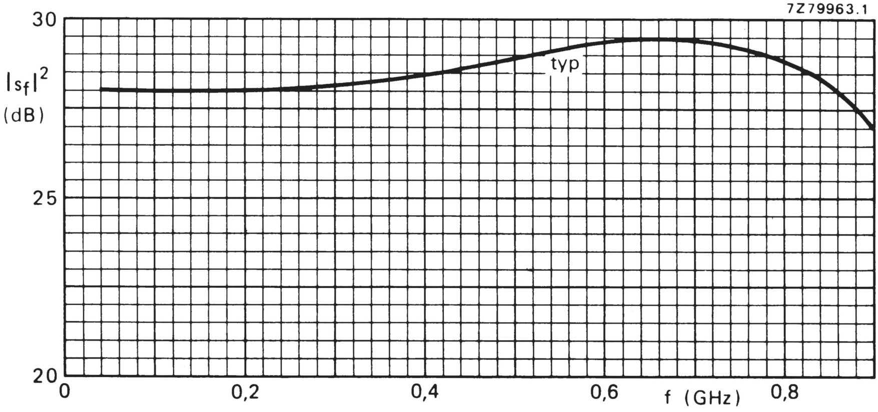


Fig. 4 Transducer gain as a function of frequency; Z_o = 75 Ω.

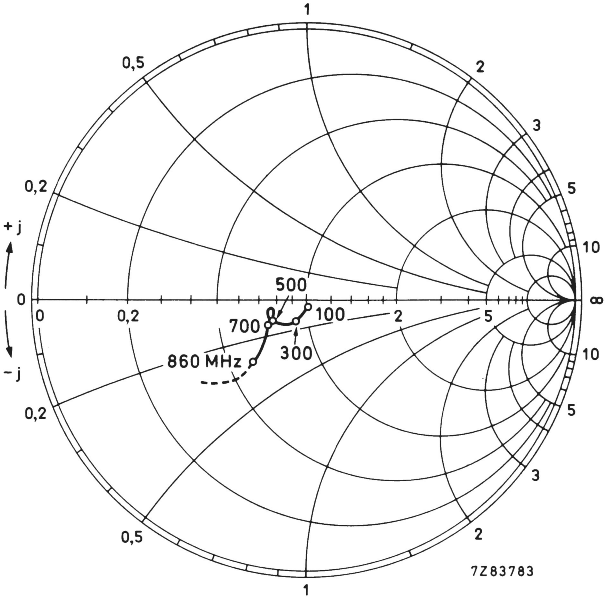


Fig. 5 Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm x 75; typical values.

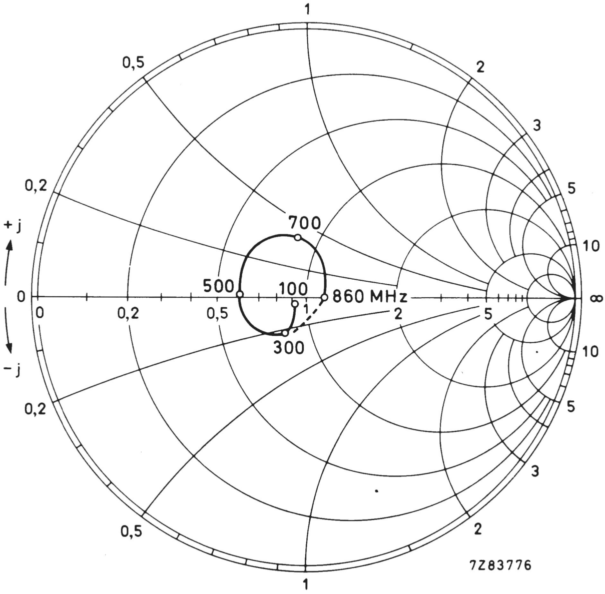


Fig. 6 Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm x 75; typical values.

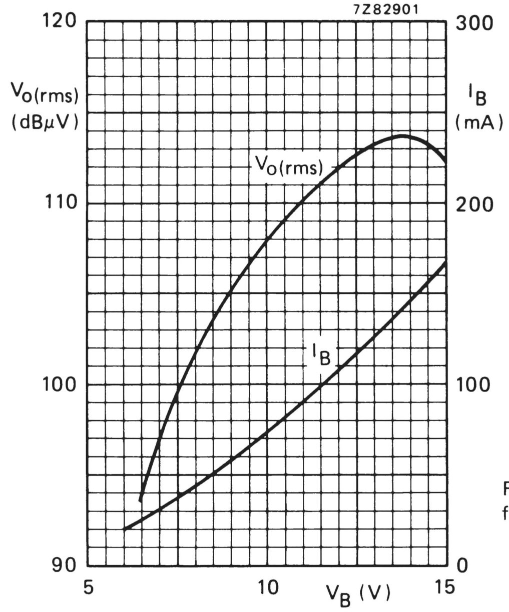


Fig. 7 Output voltage and supply current as a function of the supply voltage; typical values.

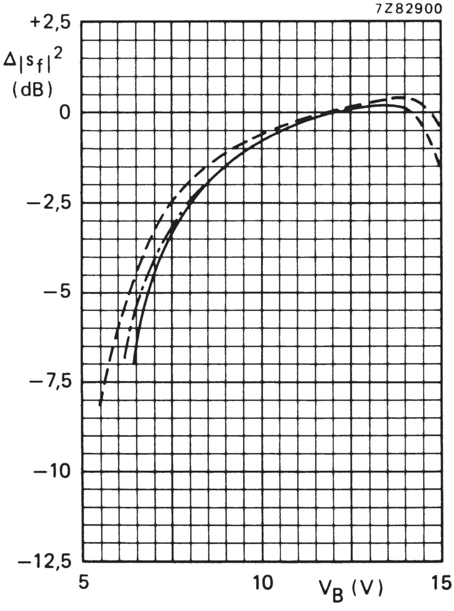


Fig. 8 Variation of transducer gain with supply voltage; reference 0 dB at 12 V;
——— f = 500 MHz;
– – – – f = 100 MHz;
—.—.—. f = 860 MHz;
typical values.

NOTES

NOTES

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A33

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